Avaya WLAN 2332 Series Outdoor Solution Guide

Avaya WLAN 2300

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Contact Avaya Support
Avaya provides a telephone number for you to use to report problems or to ask questions about your product. The support telephone number is 1-800-242-2121 in the United States. For additional support telephone numbers, see the Avaya Web site: http://www.avaya.com/support

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Basics of Avaya WLAN Series 2332 Outdoor Solution

Introduction

This document provides the basic outdoor hardware installation instructions for your WLAN Series 2332.

For information about WLAN Series 2332 Outdoor Solution with Indoor Mounted AP, refer Chapter , "WLAN Series 2332 Outdoor Solution with Indoor Mounted AP," on page 39

For information about WLAN Series 2332 Outdoor Solution with AP Mounted in NEMA Enclosure, refer Chapter , "WLAN Series 2332 Outdoor Solution with AP Mounted in NEMA Enclosure," on page 57

For more information about AP installation as well as safety and installation requirements, see the following:

- *Avaya WLAN Series 2332 Access Point Installation Guide*

What is the Avaya WLAN Series 2332 Outdoor Solution

The Avaya WLAN Series 2332 Outdoor Solution is the incorporation of existing and new Avayacomponents to provide a simple yet effective solution to wireless LAN access in outdoor locations.

Note. WLAN Series 2332 Access Points require WMS software Release 6.0.7.1 (or later) and WSS software Release 6.0.6.2 (or later) for correct configuration and operation.

Customer service

Visit the Avaya Web site to access the complete range of services and support that Avaya provides. Go to www.avaya.com or go to one of the pages listed in the following sections.

Navigation

- See "Getting technical documentation" page 8
- See "Getting product training" page 8
- See "Getting help from a distributor or reseller" page 8
- See "Getting technical support from the Avaya Web site" page 8

Getting technical documentation

To download and print selected technical publications and release notes directly from the Internet, go to www.avaya.com/support.

Getting product training

Ongoing product training is available. For more information or to register, you can access the Web site at www.avaya.com/support. From this Web site, you can locate the Training contacts link on the left-hand navigation pane.

Getting help from a distributor or reseller

If you purchased a service contract for your Avaya product from a distributor or authorized reseller, contact the technical support staff for that distributor or reseller for assistance.

Getting technical support from the Avaya Web site

The easiest and most effective way to get technical support for Avaya products is from the Avaya Technical Support Web site at www.avaya.com/support.

Regulatory compliance statements for WLAN Series 2332 Access Points

The WLAN Series 2332 Access Points consist of the following models:

2332-A1, 2332-A2, 2332-A3, 2332-A4, 2332-A5, 2332-A6, 2332-E1, 2332-E2, 2332-E3, 2332-E4, 2332-E5, 2332-E6, 2332-E7, 2332-E8, 2332-E9, 2332-J1.

Federal Communications Commission (FCC) compliance notices

This section includes the following FCC statements for the WLAN Series 2332 Access Points:

- FCC ID: RVW2332 (Applies to 2332-A1)
- Class B Interference Statement
- RF Radiation Exposure and Hazard Warning
- Non-Modification Statement
- Deployment Statement

Class B interference statement

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

FCC caution

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

RF radiation exposure and hazard statement

To ensure compliance with FCC RF exposure requirements, this device must be installed in a location such that the antenna of the device will be greater than 20 cm (8 in.) away from all persons. Using higher gain antennas and types of antennas not covered under the FCC certification of this product is not allowed. Installers of the radio and end users of the product must adhere to the installation instructions provided in this manual. This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.

Non-modification statement

Use only the supplied internal antenna, or external antennas supplied by the manufacturer. Unauthorized antennas, modifications, or attachments could damage the WLAN 2332-A1 and related Series 2332 Access Points and violate FCC regulations. Any changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate this equipment. Contact Avaya for a list of approved 2.4 GHz and 5.0 GHz external antennas.

This device must be operated with the CAT-5 Ethernet cable installed on each activated Ethernet Port of a Series 2332 Access Point to ensure compliance with the Class B emissions standards. Failure to comply with this installation requirement may cause the device to operate in excess of the allowable emissions limits.

Deployment statement

This product is certified for indoor deployment only. **Outdoor operation is allowed by exception only. Please follow the guidelines outlined in the Outdoor Operation Section in this guide.**

Dynamic Frequency Selection (DFS) in the 5.0 GHz UNII bands

The 2332-A1 access point has been prohibited, via software, from operating in the 5250 to 5350 MHz and 5470 to 5725 MHz frequency bands for the US and Canada because it cannot meet the DFS requirements as outlined in the rules of the FCC for Part 15, Subpart E that went into force on July 20, 2007.

Canadian IC statement

IC: 332R-2332 (Applies to 2332-A1).

Operation is subject to the following two conditions in Canada:

1 this device may not cause interference, and

2 this device must accept any interference, including interference that may cause undesired operation of the device

To prevent radio interference to the licensed service (i.e. co-channel Mobile Satellite systems) this device is intended to be operated indoors and away from windows to provide maximum shielding. Equipment (or its transmit antenna) that is installed outdoors is subject to licensing and not supported by the WLAN 2332-A1 Access Point.

European Union and European Free Trade Association (EFTA) regulatory compliance

This equipment may be operated in the countries that comprise the member countries of the European Union and the European Free Trade Association. These countries, listed in the following paragraph, are referred to as The European Community throughout this document:

AUSTRIA, BELGIUM, BULGARIA, CYPRUS, CZECH REPUBLIC, DENMARK, ESTONIA, FINLAND, FRANCE, GERMANY, GREECE, HUNGARY, IRELAND, ITALY, LATVIA, LITHUANIA, LUXEMBOURG, MALTA, NETHERLANDS, POLAND, PORTUGAL, ROMANIA, SLOVAKIA, SLOVENIA, SPAIN, SWEDEN, UNITED KINGDOM, ICELAND, LICHTENSTEIN, NORWAY, SWITZERLAND

The WLAN 2332-E1 and related Series 2332 Access Points communicate with Avaya WLAN - Security Switch using a standard CAT-5 (Category 5) or higher 10/100 Mbps twisted pair Ethernet cable to provide wireless local area networking (WLAN) capabilities. The WLAN 2332-E1 and related Series 2332 Access Points include one 802.11a and one 802.11b/g radio and two 802.11a and two 802.11b/g omnidirectional internal antennas. In addition, the 2332-E1 and related Series 2332 Access Points can use optional factory-supplied external omnidirectional and/or directional high-gain antennas, one per the 802.11b/g and one per the 802.11a radios, as described in the external antenna section of the WLAN Series 2332 Access Point Installation Guide. When using the external antennas, connect them to the reverse-polarity R-SMA connectors located on the side of the WLAN 2332-E1 or related Series 2332 Access Point.

Declaration of conformity

Marking by this symbol CE !

indicates compliance with the Essential Requirements of the R&TTE Directive of the European Union (1999/5/EC). This equipment meets the following conformance standards:

Safety: EN 60950-1:2001 + A11:2004

EMC: EN 55022: 2006, EN 55024:1998 + A1:2001 + A2:2003, EN301489-1 V.1.6.1, EN 301489-17 v1.2.1, CISPR22:1997, CISPR24

Including: EN 61000-3-2, -3-3, -4-2, -4-3, -4-4, -4-5, -4-6 and -4-11. The product is also licensed as required for additional country specific standards as required for the International Marketplace.

Radio: EN 300-328 v.1.7.1 (2006-10) & EN 301-893 v.1.4.1 (2007-07)

DEVIATION: The 2332-E1 and related Series 2332 access points were tested to and are compliant with all of the technical specifications of EN 301-893 v1.4.1 for operation in the 5.0 GHz bands, except the DFS requirements in the 5600 – 5650 MHz band.

IEEE 802.11a operation in the 5250 to 5350 MHz and 5470 to 5725 MHz frequency bands is governed by ETSI EN 301-893 v1.4.1 and the R&TTE Directive 1999/5/EC. Effective July 1, 2008, EN 301-893 v1.4.1 was updated to require compliance with 0.8 µsecond pulse widths and staggered PRF's in the 5470 – 5725 MHz band. The 2332-E1 access point meets compliance with these new mandates by disabling operation, via software, on channels 120, 124, 128 and 132 in the 5600 to 5650 MHz frequency band because it cannot meet the 0.8 µsecond pulse width and staggered PRF DFS requirements as outlined in the updated EN 301-893v1.4.1 standard.

Electromagnetic compatibility and Radio spectrum Matters (ERM); Wideband transmission systems; Data transmission equipment operating in the 2,4 GHz ISM band and using wide band modulation techniques and Broadband Radio Access Networks (BRAN); 5 GHz high performance RLAN. Certifications are harmonized to the EN standards covering essential requirements under article 3.2 of the R&TTE Directive. Compliance includes testing with antennas as specified in attached table.

SAR: EN 50385:2002

European Community declaration of conformity

WLAN Radio Model 2332, as stated in the following Declarations of Conformity, represents all models in the Series 2332 as listed above.

Bulgaria	български С това, avaya обявява, че този модел на радио на WLAN Радио Модел 2332, е със съгласие с съществените изисквания и други важни условия на директива 1999/5 на европейски съюз
Czech Republic	Èesky Avayatímto prohlašuje, že tento WLAN Rádio Model 2332, je ve shodì se základními požadavky a dalšími pøíslušnými ustanoveními smìrnice 1999/5/ES.
Denmark	Dansk Undertegnede Avayaerklærer herved, at følgende udstyr WLAN Radio Model 2332, overholder de væsentlige krav og øvrige relevante krav i direktiv 1999/5/EF.
English	English Hereby, Avaya declares that this WLAN Radio Model 2332, is in compliance with the essential requirements and other relevant provisions of Directive 1999/5/EC.
Estonia	Eesti Käesolevaga kinnitab Avayaseadme WLAN Radio Model 2332, vastavust direktiivi 1999/5/EÜ põhinõuetele ja nimetatud direktiivist tulenevatele teistele asjakohastele sätetele.
Finland	Suomi Avayavakuuttaa täten että WLAN Radio Esikuvallinen 2332, tyyppinen laite on direktiivin 1999/5/EY oleellisten vaatimusten ja sitä koskevien direktiivin muiden ehtojen mukainen.
France	Français Par la présente Avayadéclare que l'appareil Model Par radio 2332 de WLAN, est conforme aux exigencies essentielles et aux autres dispositions pertinentes de la directive 1999/5/CE.

Germany	Deutsch Hiermit erklärt Avaya., dass sich das Gerät WLAN Radiomodell 2332, in Übereinstimmung mit den grundlegenden Anforderungen und den übrigen einschlägigen Bestimmungen der Richtlinie 1999/5/EG befindet.
Greece	ΕΛΛΗΝΙΚΗ ÌÅ ÔÇÍ ÐÁÑÏÕÓÁ Avaya. ÇË.ÍÅÉ ÏÔÉ WLAN ραδιο πρότυπο 2332, ÓÕÌÌÏÑÖ.ÍÅÔÁÉ ÐÑÏÓ ÔÉÓ ÏÕÓÉ..ÅÉÓ ÁÐÁÉÔÇÓÅÉÓ ÊÁÉ ÔÉÓ ËÏÉÐÅÓ Ó×ÅÔÉÊÅÓ .ÉÁÔÁÎÅÉÓ ÔÇÓ Ï.ÇÃÉÁÓ 1999/5/ÅÊ.
Hungary	Magyar Alulírott, Avayanyilatkozom, hogy a WLAN Rádió Minta 2332, megfelel a vonatkozó alapvetõ követelményeknek és az 1999/5/EC irányelv egyéb elõírásainak.
Italy	Italiano Con la presente Avayadichiara che questo Modello Radiofonico 2332 di WLAN, è conforme ai requisiti essenziali ed alle alter disposizioni pertinenti stabilite dalla direttiva 1999/5/CE.
Latvia	Latviski Ar šo Avayadeklarç, ka WLAN Radio Model 2332, atbilst Direktîvas 1999/5/EK bûtiskajâm prasîbâm un citiem ar to saistîtajiem noteikumiem.
Lithuania	Lietuviø Šiuo Avayadeklaruoja, kad šis WLAN Radio Model 2332, atitinka esminius reikalavimus ir kitas 1999/5/EB Direktyvos nuostatas.
Malta	Malti Hawnhekk, Avaya., jiddikjara li dan WLAN Radio Model 2332, jikkonforma mal-tiijiet essenzjali u ma provvedimenti orajn relevanti li hemm fid-Dirrettiva 1999/5/EC.
Netherlands	Netherlands Hierbij verklaart Avayadat het toestel WLAN Radiomodel 2332, in overeenstemming is met de essentiële eisen en de andere relevante bepalingen van richtlijn 1999/5/EG.
Poland	Polski Niniejszym Avayaooewiadcza, ¿e WLAN Radio Model 2332, jest zgodny z zasadniczymi wymogami oraz pozosta³ymi stosownymi postanowieniami Dyrektywy 1999/5/EC.
Portugal	Português Avayadeclara que este Modelo De rádio 2332 de WLAN, está conforme com os requisitos essenciais e outras disposições da Directiva 1999/5/CE.

Romania	Român Astfel, Avaya declarã acel acest WLAN Radio Model 2332, este în conformitate cu cerinþele necesare ºi proviziile alte semnificative de Directive 1999 5 EC.
Slovakia	Slovensky Avayatýmto vyhlasuje, že WLAN Radio Model 2332 spåòa základné požiadavky a všetky príslušné ustanovenia Smernice 1999/5/ES.
Slovenia	Slovensko Avayaizjavlja, da je ta WLAN Radio Model 2332, v skladu z bistvenimi zahtevami in ostalimi relevantnimi doloèili directive 1999/5/ES.
Spain	Español Por medio de la presente Avayadeclara que el Modelo De radio 2332 de WLAN, cumple con los requisitos esenciales y cualesquiera otras disposiciones aplicables o exigibles de la Directiva 1999/5/CE.
Sweden	Svenska Härmed intygar Avayaatt denna WLAN Radiotelegrafera till Modell 2332, står I överensstämmelse med de väsentliga egenskapskrav och övriga relevanta bestämmelser som framgår av direktiv 1999/5/EG.

Countries of operation and restrictions of use in the European Community

Operation using the 2.400 to 2.4835 GHz channels in the European Community

The professional installer should use the configuration utility provided with this product to verify the current channel of operation, the expected transmit power level, and to confirm that the device is operating in conformance with the spectrum usage rules for the selected European Community country. If operation is occurring outside of the allowable channels as indicated in this guide, then operation of the product must cease immediately and the installer must consult with the local technical support staff responsible for the wireless network.

This device is intended to be operated in all countries of the European Community. Additional restrictions of use for the 2332-E1 and related Series 2332 Access Points within the European Community countries in the 2.400 to 2.4835 GHz band are listed below.

- The frequencies associated with channels 1 to 13 in the 2.400 to 2.4835 GHz band are allowed to be used either indoors or outdoors in all countries of the European Community, except where noted in the Outdoor Operation Section.

The 2332-E1 and related Series 2332 Access Points, whether using the internal or approved external antennas, is guaranteed to meet this limit by automatically adjusting the transmit power level through the operating software depending upon the gain of the selected antenna.

Operation using the 5.15 to 5.25 GHz, 5.25 to 5.35 GHz, and 5.470 to 5.725 GHz channels in the European Community

To remain in conformance with European National spectrum usage laws, follow the channel limitations associated with the 5 GHz bands as specified in this document. The professional installer should verify the current channel of operation and the expected transmit power level of the 2332-E1 or related Series 2332 Access Point to confirm that the device is operating in conformance with the spectrum usage rules for the European Community country where the unit is being installed. If operation is occurring outside of the allowable frequencies or above the power levels, as indicated in this guide, then operation of the product must cease immediately and the installer must consult with the local technical support staff responsible for the wireless network.

This device is intended to be operated in all countries of the European Community. Additional restrictions of use for the 2332-E1 and related Series 2332 Access Points within the European Community countries in the 5.15 to 5.25 GHz, 5.25 to 5.35 GHz, and 5.470 to 5.725 GHz bands are listed below.

- This device is restricted to indoor use only when operated in the European Community using the 5.15-5.25 GHz and 5.25-5.35 GHz bands, which includes channels 36, 40, 44, 48, 52, 56, 60 and 64.
- The 5 GHz Turbo Mode feature is not allowed for operation in any European Community country.

Dynamic Frequency Selection (DFS)

The 2332-E1 and related Series 2332 Access Points implement a DFS feature in accordance with the limits in EN 301-893v1.4.1, Section 4.7 and Annex D, Tables D.1, D.2 and D.4 for a device operating in the mode defined as "Master". Section 4.7, Tables 5 of this document define the requirements prior to using a channel and during normal operation for a Master device (i.e., Interference Detection Threshold, Channel Availability Check Time, Uniform Spreading, Channel Closing Transmission Time and Channel Move Time). This product qualifies for this category since the maximum achievable transmit power is greater than 23 dBm per the requirements of Table D.2 in Annex D of the standard.

IEEE 802.11a operation in the 5250 to 5350 MHz and 5470 to 5725 MHz frequency bands is governed by ETSI EN 301-893v1.4.1 and the R&TTE Directive 1999/5/EC. Effective July 1, 2008, EN 301-893 v1.4.1 was updated to require compliance with 0.8 µsecond pulse widths and staggered PRF's in the 5470 – 5725 MHz band. The 2332-E1 access point meets compliance with these new mandates by disabling operation, via software, on channels 120, 124, 128 and 132 in the 5600 to 5650 MHz frequency band because it cannot meet the 0.8 µsecond pulse width and staggered PRF DFS requirements as outlined in the updated EN 301-893v1.4.1 standard.

Transmit Power Control (TPC)

European Regulatory requirements specify that wireless devices must employ Transmit Power Control (TPC) to reduce the potential for interference to other communication systems operating in the 5 GHz frequency bands. This device includes a provision for adjustment of Transmit Power in accordance with the limits in EN 301-893v1.4.1, Sections 4.4.2.1 and 4.4.2.2.

Korea MIC Compliance Statement

당해 무선설비는 운영 중 전파혼신 가능성이 있음

Possible radio wave interference during operation of concerned radio equipment.

B. For Home Use (Class B device)

B 급 기기 (가정용 정보통신기기)

이 기기는 가정용으로 전자파 적합 등록을 받은 기기로서,
주거 지역에서는 물론 모든 지역에서 사용할 수 있습니다.

This product obtained EMC Registration for home use. It can be used in all areas, including homes.

Taiwan Compliance Statement

802.11b/802.11g/BT 警語：

第十二條→經型式認證合格之低功率射頻電機，非經許可，公司，商號或使用者均不得

擅自變更頻率、加大功率或變更原設計之特性及功能。

第十四條→低功率射頻電機之使用不得影響飛航安全及干擾合法通信；經發現有干擾現

象時，應立即停用，並改善至無干擾時方得繼續使用。

前項合法通信，指依電信法規定作業之無線電通信。 低功率射頻電機須忍受合法通信

或工業、科學及醫療用電波輻射性電機設備之干擾。

Article 12

Without permission granted by the NCC, any company, enterprise, or user is not allowed to change frequency, enhance transmitting power or alter original characteristic as well as performance to an approved low power radio-frequency device.

Article 14

The low power radio-frequency devices shall not influence aircraft security and interfere with legal communications. If found, the user shall cease operating immediately until no interference is achieved. The said legal communications means radio communications is operated in compliance with the Telecommunications Act.

The low power radio-frequency devices must be susceptible with the interference from legal communications or ISM radio wave radiated devices.

LP0002

802.11a 警語： Unlicensed National Information Infrastructure, U-NII

4.7→無線傳輸設備(UNII)

4.7.5→在 5.25-5.35 秭赫頻炎內操作之無線資訊傳輸設備，限於室內使用。

4.7.6→無線資訊傳輸設備忍受合法通信之干擾且不得干擾合法通信；如造成干擾，應立

即停用，俟無干擾之虞，始得繼續使用。

4.7.7→無線資訊傳設備的製造廠商應確保頻率穩定性，如依製造廠商使用手冊上所述正

常操作，發射的信號應維持於操作頻帶中。

加印警語→「避免電波干擾，本器材禁止於室外使用 5.25-5.35 姊赫頻帶」於器材使用說

明書內，並將警語印製貼紙可黏貼於裝設器材機身外明處。

4.7.5 Within the 5.25-5.35 GHz band, U-NII devices will be restricted to indoor operations to reduce any potential for harmful interference to co-channel MSS operations.

4.7.6 The operation of the U-NII devices is subject to the conditions that no harmful interference is caused. The user must stop operating the device immediately should harmful interference be caused and shall not resume until the condition causing the harmful interference has been corrected.

Moreover, the interference must be accepted that may be caused by the operation of an authorized communications, or ISM equipment.

4.7.7 Manufacturers of U-NII devices are responsible for ensuring frequency stability such that an emission is maintained within the band of operation under all conditions of normal operation as specified in the user manual.

Outdoor Operating Restrictions

United States and Canada

2.4 GHz Band

IEEE 802.11b/g operation in the 2.400 to 2.4835 GHz ISM band is governed by FCC Part 15, Subparts B & C in the US and IC RSS-210 in Canada. These rules state that the parameters for both indoor and outdoor operation in this frequency band are identical.

5.0 GHz Bands

IEEE 802.11a operation in the following frequency bands, is governed by FCC Part 15, Subparts B & C and FCC Part 15, Subpart E for the US and IC RSS-210, Issue 6 in Canada. There are restrictions of use in the 5.0 GHz frequency bands and they are outlined below:

Table 1: Restrictions of use in 5.0 GHz frequency bands

5150 to 5250 MHz:	Operation is restricted to **INDOOR use ONLY** (FCC Part 15.400 & IC RSS-210)
5250 to 5350 MHz:	Operation can be used indoors or outdoors (FCC Part 15.400 & IC RSS-210)
5470 to 5725 MHz:	Operation can be used indoors or outdoors (FCC Part 15.400 & IC RSS-210)
5725 to 5825 MHz:	Operation can be used indoors or outdoors (FCC Part 15.400 & IC RSS-210)
5725 to 5875 MHz:	Operation can be used indoors or outdoors (FCC Part 15.247)

The software settings that govern the operating parameters of the 2332-A1 Access Point have been constructed to prohibit operation in the 5150 to 5250 MHz band when either "outdoor" mode or an "outdoor antenna configuration" is selected. Please refer to the External Antenna Selection Guide for a complete listing of the indoor and outdoor antennas.

In addition, the 2332-A1 Access Point has been prohibited, via software, from operating in the 5250 to 5350 MHz and 5470 to 5725 MHz frequency bands because it cannot meet the DFS requirements as outlined in the rules of the FCC for Part 15, Subpart E that come into force on July 20, 2007.

European Union (EU) and European Fair Trade Association (EFTA)

2.4 GHz Band

IEEE 802.11b/g operation in the 2400 to 2483.5 MHz WLAN band is governed by ETSI EN 300-328 v1.7.1. These rules state that the parameters for both indoor and outdoor operation in this frequency band are identical in all member states, except those listed below:

Table 2: Excepted member states

France:	Operation outdoors for IEEE 802.11b/g is limited to 2400 to 2454 MHz, channels 1 through 7, at a maximum EIRP of 100 mW. The 2332-E1 Access Point is disabled from operating on Channels 8 through 13 when either "outdoor" mode or an "outdoor antenna configuration" is selected.
Italy:	Operation outdoors for IEEE 802.11b/g is prohibited without obtaining a license. If the 2332-E1 is to be used beyond the boundaries of the owner's property, a general authorization is required from the Ministry of Communications. Please check http://www.comunicazioni.it/it for further details. Operation on all channels has been prohibited when either "outdoor" mode or an "outdoor antenna configuration" is selected.
Latvia:	Operation outdoors for IEEE 802.11b/g is prohibited without obtaining a license. If the 2332-E1 is to be used beyond the boundaries of the owner's property, outdoors or with an outdoor antenna, a general authorization is first required from the Electronic Communications Office. Please check http://www.esd.lv for further details. Operation on all channels has been prohibited when either "outdoor" mode or an "outdoor antenna configuration" is selected.

5.0 GHz Bands

IEEE 802.11a operation in the frequency bands listed below, are governed by ETSI EN 301-893v 1.4.1 and the R&TTE Directive 1999/5/EC. Effective July 1, 2008, EN 301-893 v1.4.1 was updated to require compliance with 0.8 µsecond pulse widths and staggered PRF's in the 5470 – 5725 MHz band. The 2332-E1 access point meets compliance with these new mandates by disabling operation, via software, on channels 120, 124, 128 and 132 in the 5600 to 5650 MHz frequency band because it cannot meet the 0.8 µsecond pulse width and staggered PRF DFS requirements as outlined in the updated EN 301-893v1.4.1 standard.

Table 3: Restrictions of use in 5.0 GHz frequency bands

5150 to 5250 MHz:	Operation is restricted to **INDOOR use ONLY**
5250 to 5350 MHz:	Operation is restricted to **INDOOR use ONLY**
5470 to 5725 MHz:	Operation can be used indoors or outdoors per EN 301-893893 v1.4.1
5725 to 5850 MHz:	Operation currently **NOT ALLOWED** or supported in the 2332-E1 Access Point.

Operating parameters for both indoor and outdoor operation in the frequency bands listed above are identical in all member states, except those listed below:

Table 4: Excepted Member States

France:	No operation is permitted in either the 5.25 to 5.35 GHz or 5.470 to 5.725 GHz bands because the device is noncompliant with the DFS requirements stated in EN 301-893 v1.3.1. Therefore, no outdoor operation is supported in France for the 2332-E1 Access Point.
Italy:	Operation outdoors for IEEE 802.11a is prohibited without obtaining a license. If the 2332-E1 is to be used beyond the boundaries of the owner's property, a general authorization is required from the Ministry of communications. Please check http://www.comunicazioni.it/it for further details. Operation on all channels has been prohibited when either "outdoor" mode or an "outdoor antenna configuration" is selected.

Country Specific Outdoor Operation Restrictions

The following restrictions of use for outdoor operation apply to the Series 2332 Access Points. These must be followed to meet local regulatory restrictions and ensure that the access points operate in the appropriate modes.

Table 5: 2.4 GHz Outdoor Restrictions

REGION	RESTRICTIONS
MIDDLE EAST	
Egypt	Outdoor operation is **NOT** permitted in the 2.4 GHz band
Israel	Outdoor operation is permitted on Channels 5 to 13 **ONLY**
Jordan	Outdoor operation is **NOT** permitted in the 2.4 GHz band
Kuwait	Outdoor operation is **NOT** permitted in the 2.4 GHz band
Qatar	Outdoor operation is **NOT** permitted in the 2.4 GHz band
Saudi Arabia	Outdoor operation is **NOT** permitted in the 2.4 GHz band
United Arab Emirates	Outdoor operation is **NOT** permitted in the 2.4 GHz band
AFRICA	
Morocco	Cannot use antennas 24883, 24113, 24123 or 24143 for outdoor operation.
CALA	
Mexico	Channels 1 through 6 allowed for outdoor operation **ONLY**

Table 6: 5.0 GHz Outdoor Restrictions

REGION	RESTRICTIONS
Europe	
Russian Federation	Outdoor operation is **NOT** permitted in the 5.0 GHz bands
APAC	
Australia	**5150 to 5250 MHz** and **5250 to 5350 MHz** operation is restricted to **INDOOR use ONLY**
Hong Kong	**5150 to 5250 MHz** and 5**250 to 5350 MHz** operation is restricted to **INDOOR use ONLY**
India	Outdoor operation is **NOT** permitted in the 5.0 GHz bands
Indonesia	Outdoor operation is **NOT** permitted in the 5.0 GHz bands
Japan	Outdoor operation is **NOT** permitted in the 5.0 GHz bands

Table 6: 5.0 GHz Outdoor Restrictions

REGION	RESTRICTIONS
Europe	
New Zealand	**5150 to 5250 MHz** and **5250 to 5350 MHz** operation is restricted to **INDOOR use ONLY**
Philippines	**5150 to 5250 MHz** operation is restricted to **INDOOR use ONLY**
Taiwan	**5250 to 5350 MHz** operation is restricted to **INDOOR use ONLY**
Thailand	Outdoor operation is **NOT** permitted in the 5.0 GHz bands
Vietnam	**5150 to 5250 MHz** operation is restricted to **INDOOR use ONLY**
MIDDLE EAST	
Bahrain	Outdoor operation is **NOT** permitted in the 5.0 GHz bands
Egypt	Outdoor operation is **NOT** permitted in the 5.0 GHz bands
Israel	Outdoor operation is **NOT** permitted in the 5.0 GHz bands
Jordan	Outdoor operation is **NOT** permitted in the 5.0 GHz bands
Kuwait	Outdoor operation is **NOT** permitted in the 5.0 GHz bands
Oman	**5150 to 5250 MHz** and **5250 to 5350 MHz** operation is restricted to **INDOOR use ONLY**
Qatar	Outdoor operation is **NOT** permitted in the 5.0 GHz bands
Saudi Arabia	Outdoor operation is **NOT** permitted in the 5.0 GHz bands
United Arab Emirates	Outdoor operation is **NOT** permitted in the 5.0 GHz bands
AFRICA	
Kenya	**5150 to 5250 MHz** operation is restricted to **INDOOR use ONLY**
Mauritius	**5150 to 5250 MHz** and **5250 to 5350 MHz** operation is restricted to **INDOOR use ONLY**
Morocco	**5150 to 5250 MHz** operation is restricted to **INDOOR use ONLY**
AFRICA	
South Africa	**5150 to 5250 MHz** and **5250 to 5350 MHz** operation is restricted to **INDOOR use ONLY**
Turkey	**5150 to 5250 MHz** and **5250 to 5350 MHz** operation is restricted to **INDOOR use ONLY**
CALA	
Chile	Outdoor operation is **NOT** permitted in the 5.0 GHz bands
Columbia	**5150 to 5250 MHz** operation is restricted to **INDOOR use ONLY**

Costa Rica	Outdoor operation is **NOT** permitted in the 5.0 GHz bands
Dominican Republic	**5150 to 5250 MHz** operation is restricted to **INDOOR use ONLY**
Jamaica	**5150 to 5250 MHz** operation is restricted to **INDOOR use ONLY**
Mexico	**5150 to 5250 MHz** operation is restricted to **INDOOR use ONLY**
Panama	**5150 to 5250 MHz** operation is restricted to **INDOOR use ONLY**
Peru	**5150 to 5250 MHz** operation is restricted to **INDOOR use ONLY**
Venezuela	**5150 to 5250 MHz** and **5250 to 5350 MHz** operation is restricted to **INDOOR use ONLY**

External Antenna Statement

Intentional radiators, such as the Avaya WLAN Series 2332 Access Point are not intended to be operated with any antenna(s) other than those furnished by Avaya. An intentional radiator may only be operated with the antenna(s) with which it is authorized. For a complete listing of the authorized antennas for use with this product, visit

http://www.avaya.com/support

In order to ensure continued compliance, use of an antenna not on the Avaya approved antenna list is not allowed without specific authorization from Avaya. Use of an antenna not specifically authorized by Avaya may not comply with local regulatory requirements with respect to radiated emission limits and may result in illegal operation of the product. The installer of the wireless system and associated antenna is required to ensure that only those antennas on the Avaya approved antenna list or those antennas specifically approved by Avaya on a case by case basis are deployed with the intentional radiator. Be sure to associate the appropriate antenna model number and localized regulatory region when selecting the Avaya authorized antenna(s).

Country Specific External Antenna Restrictions

The following list of countries cannot use the Avaya approved antennas listed in the table. Use of these antennas would violate the local regulatory rules and approved certifications for that country or operation is not allowed in the specified frequency bands.

Country	2.4 GHz	5.0 GHz
Costa Rica		ALL antenna models
Indonesia		ALL antenna models
Japan		S51514WPN36RSM
		S4901790PN36RS
		SR49120DAN36RS
	SR24120DN36RSM	
Korea	S2406PN36RSM	S51514WPN36RSM

Country	2.4 GHz	5.0 GHz
	S2409PN36RSM	S4901790PN36RS
	PC2415NA36RSM	SR49120DAN36RS
	S241290PN36RSM	
	SR24120DN36RSM	
Nigeria		ALL antenna models
Russian Federation		ALL antenna models
Thailand		ALL antenna models

Translated caution statements, warning conventions and warning messages

The following caution statement, warning conventions, and warning messages apply to this manual.

Caution! The Series 2332 Access Point radios are disabled by default and can be enabled only by a system administrator using the WSS.

Attention! Les communications radios du Series 2332 Access Point sont désactivées par défaut et peuvent être activées uniquement par un administrateur système utilisant le WSS.

Achtung! Die Series 2332 Access Point Radios sind standardmäßig ausgeschaltet und können nur durch einen Systemadministrator unter Verwendung des WSS eingeschaltet werden.

Precaucion! Las radios Series 2332 Access Point se desactivan en forma predeterminada y pueden activarse sólo con un administrador de sistema utilizando el WSS.

Cuidado! Os rádios do Series 2332 Access Point estão desativados por padrão e só podem ser ativados por um administrador de sistema usando WSS.

Attenzione! Le radiazioni del dispositivo Series 2332 Access Point vengono disattivate per impostazione predefinita e possono essere attivate soltanto da un amministratore di sistema tramite WSS.

Caution! Do not install the outdoor antenna or connect it to the surge suppressor/Access Point during a storm.

Attention ! N'installez pas l'antenne extérieure ou ne la reliez pas au point de la montée subite suppressor/Access pendant un donner l' assaut à.

Achtung! Bringen Sie nicht die im Freienantenne an oder schließen Sie sie an den Schwankung suppressor/Access Punkt während eines Sturms an.

Precaución! No instale la antena al aire libre ni conéctela con el punto de la oleada suppressor/Access durante una tormenta.

Cuidado! Não instale a antena ao ar livre nem não a conecte ao ponto do surge suppressor/Access durante uma tempestade.

Attenzione! Non installare o collegare l'antenna esterna allo stabilizzatore di corrente/punto di accesso durante un temporale. .

Caution! The power source equipment connected to the Access Point, such as the Wireless Security Switch or PoE injector, must be provided with a reliable earth ground to ensure safety of the system.

Attention ! La source d'alimentation branchée au point d'accès (commutateur de sécurité sans fil ou alimentation électrique par câble Ethernet) doit être équipé d'une mise à la terre fiable afin de garantir la sécurité du système.

Achtung! Die mit dem Zugriffspunkt verbundene Stromversorgungsanlage wie etwa der WLAN-Sicherheitsschalter oder der PoE-Injektor muss korrekt geerdet sein, um die Sicherheit des Systems zu gewährleisten..

Precaución! El equipo de suministro eléctrico conectado al Access Point (Punto de acceso), como por ejemplo un Wireless Security Switch (Suiche de seguridad inalámbrico) o PoE injector (inyector de corriente por Ethernet), debe contar con una conexión a tierra confiable para garantizar la seguridad del sistema..

Cuidado! O equipamento de fonte de energia conectado ao Ponto de acesso, como o Wireless Security Switch (Interruptor de segurança sem fio) ou o injetor PoE, devem estar equipados com um fio terra confiável se modo a garantir a segurança do sistema.

Attenzione! l'apparecchiatura di alimentazione collegata al punto di accesso, ad esempio il Wireless Security Switch o l'iniettore PoE, deve essere dotata di un'adeguata messa a terra per garantire la sicurezza del sistema.

Warning conventions

Warning! This situation or condition can cause injury.

Avertissement! Cette situation ou cette condition peuvent provoquer des blessures.

Warnung! Diese Situation oder dieser Zustand kann zu Verletzungen führen.

Advertencia! Esta situação ou condição podem causar dano.

Aviso! Esta situación o condición puede causar lesiones.

Avviso! Situazione o condizione che può causare ferite.

Warning! High voltage. This situation or condition can cause injury due to electric shock.

Avertissement! Haute tension. Cette situation ou cette condition peuvent provoquer des blessures dues à des décharges électriques.

Warnung! Hochspannung. Diese Situation oder dieser Zustand kann einen Elektroschock verursachen.

Advertencia! Voltagem alta. Esta situação ou condição podem causar dano devido a choque elétrico.

Aviso! Alta tensión. Esta situación o condición puede causar lesiones por descarga eléctrica.

Avviso! Alta tensione. Questa situazione o condizione può causare ferite dovute a scosse elettriche.

Qualified service personnel warning

Warning! Installation must be performed by qualified service personnel only. Read and follow all warning notices and instructions marked on the product or included in the documentation.

Avertissement! L'installation doit être effectuée uniquement par des techniciens qualifiés. Lisez et suivez toutes les notices d'avertissement et les instructions figurant sur le produit ou comprises dans la documentation.

Warnung! Nur qualifiziertes Wartungspersonal darf die Installation vornehmen. Lesen und befolgen Sie die Warnungshinweise und Anweisungen, die auf dem Produkt gekennzeichnet oder in der Dokumentation enthalten sind.

Advertencia! Sólo el personal de servicio calificado podrá realizar la instalación. Lea y siga todas las instrucciones y advertencias marcadas en el producto o incluidas en la documentación.

Aviso! Apenas profissionais de atendimento técnico qualificados devem realizar a instalação. Leia e siga todos os avisos e instruções destacados no produto ou que façam parte da documentação.

Avviso! L'installazione deve essere eseguita esclusivamente da personale qualificato. Leggere e seguire tutti gli avvisi e le istruzioni presenti sul prodotto o inclusi nella documentazione

Radio safety warnings

Warning! Install this device in such a manner as to maintain a minimum of 20 cm (7.9 inches) separation distance between the radiating element(s) and all persons. This safety warning conforms with FCC radio frequency exposure limits.

Avertissement! Installez cet appareil de façon à maintenir une distance d'au moins 20 cm entre les éléments rayonnants et tout individu. Cet avertissement de sécurité est conforme aux limites d'exposition aux radiofréquences établies par la FCC.

Warnung! Installieren Sie das Gerät so, dass zwischen dem strahlenden Element bzw. den strahlenden Elementen und allen Personen mindestens ein Abstand von 20 cm eingehalten wird. Diese Sicherheitswarnung richtet sich nach den Grenzwerten für die Belastung durch Hochfrequenz der FCC

Advertencia! Instale este dispositivo de tal manera que mantenga una distancia de separación mínima de 20 cm. (7.9 pulgadas) entre los elementos emisores y todas las personas. Esta advertencia de seguridad está de acuerdo con los límites de exposición de frecuencia radioeléctrica de la FCC (Comisión Federal de las Comunicaciones).

Aviso! Instale o dispositivo de modo que exista um mínimo de 20 cm (7,9 polegadas) de distância de separação entre o(s) elemento(s) radiador(es) e as pessoas. Esse aviso de segurança está em conformidade com os limites de exposição à radiofreqüência especificados pela FCC.

Avviso! Installare il dispositivo in modo tale da mantenere una distanza minima di 20 cm tra gli elementi irradianti e le persone. Questo avviso sulla sicurezza è conforme ai limiti FCC sull'esposizione alla frequenza radio.

Warning! Do not operate access point near unshielded blasting caps or in an otherwise explosive environment unless the device has been modified for such use by qualified personnel.

Avertissement! Ne faites pas fonctionner de point d'accès à proximité de détonateurs non blindés ou dans des milieux présentant des risques d'explosion à moins que l'appareil n'ait été modifié pour cet usage par un personnel qualifié.

Warnung! Bedienen Sie den Zugangspunkt nicht in der Nähe von unabgeschirmten Zündkapseln oder anderweitig explosionsgefährdeten Umgebungen, außer das Gerät wurde durch geschultes Wartungspersonal für diese Verwendung geändert.

Advertencia! No maneje el punto de acceso cerca de cápsulas detonadoras no aisladas o en ambientes explosivos a menos que el dispositivo haya sido modificado para ese uso por personal calificado.

Aviso! Não opere um ponto de acesso próximo a detonadores sem proteção ou em ambientes explosivos a não ser que o dispositivo tenha sido modificado para ser desta forma utilizado por pessoal qualificado.

Avviso! Non utilizzare il punto di accesso nelle vicinanze di involucri esplosivi non schermati o in qualsiasi ambiente in cui siano presenti sostanze esplosive, a meno che il dispositivo non sia stato modificato per tale uso da personale qualificato.

Warning! Do not touch or move the access point when the antennas are transmitting or receiving.

Avertissement! Ne touchez pas le point d'accès lors de l'émission ou de la réception des antennes.

Warnung! Berühren und bewegen Sie den Zugangspunkt nicht, wenn die Antennen senden oder empfangen.

Advertencia! No toque ni mueva el punto de acceso cuando las antenas transmiten o reciben.

Aviso! Não toque ou desloque o ponto de acesso enquanto as antenas estiverem transmitindo ou recebendo dados.

Avviso! Non toccare o spostare il punto di accesso mentre le antenne sono in fase di trasmissione o ricezione.

Warning! Before using a wireless device in a hazardous location, consult the local codes, national codes, and safety directors of the location for usage constraints.

Avertissement! Avant d'utiliser un appareil sans fil dans un endroit dangereux, consultez la réglementation locale et nationale ainsi que les responsables de la sécurité de l'endroit concerné pour obtenir des informations relatives aux conditions et aux limites d'utilisation de cet appareil.

Warnung! Bevor Sie ein drahtloses Gerät an einem gefährlichen Ort verwenden, informieren Sie sich über die regionalen und landesweiten Gesetze, und wenden Sie sich an Orten mit Nutzungsbeschränkungen an die Sicherheitsbeauftragten.

Advertencia! Antes de utilizar un dispositivo inalámbrico en una ubicación peligrosa, consulte los códigos locales, nacionales y los directorios de seguridad de la ubicación acerca de las restricciones de uso.

Aviso! Antes de usar um dispositivo sem fio em local perigoso, consulte as normas locais e nacionais, além de diretrizes de segurança locais para se informar sobre restrições de uso.

Avviso! Prima di utilizzare un dispositivo wireless in un ambiente pericoloso, controllare i codici locali e nazionali e consultare i relativi servizi antinfortunistici per le restrizioni sull'uso.

Warning! Intentional radiators, such as the Avaya WLAN Series 2332 Access Point are not intended to be operated with any antenna(s) other than those furnished by Avaya. An intentional radiator may only be operated with the antenna(s) with which it is authorized. For a complete listing of the authorized antennas for use with this product, visit http://www.avaya.com/support.

Avertissement! Les émetteurs intentionnels, tels que les points d'accès WLAN Series 2332 de Avaya ne sont pas destinés à fonctionner avec des antennes autres que celles fournies par Avaya. Un émetteur intentionnel peut fonctionner uniquement avec une antenne agréée. Pour une liste complète des antennes agréées à utiliser avec ce produit, rendez-vous sur le site Web http://www.avaya.com/support.

Warnung! Vorsätzliche Funksender wie der Avaya WLAN Series 2332 Access Point dürfen nicht mit anderen, als den von Avaya bereitgestellten Antennen verwendet werden. Ein vorsätzlicher Funksender darf nur mit den Antennen verwendet werden, für die er autorisiert ist. Eine vollständige Liste mit allen autorisierten Antennen für dieses Produkt finden Sie unter http://www.avaya.com/support.

Advertencia! Los equipos que generan transmisiones intencionales, como el Punto de acceso Series 2332 WLAN de Avaya no están ideados para funcionar con ninguna antena que no esté diseñada por Avaya. Los equipos que generan transmisiones intencionales pueden funcionar sólo con las antenas para las que están autorizados. Para obtener una lista completa de las antenas autorizadas para este producto, visite http://www.avaya.com/support.

Aviso! Radiadores por definição, como o Avaya WLAN Series 2332 Access Point não devem ser operados com nenhuma outra antena senão aquela fornecida pela Avaya. Estes radiadores devem operar apenas com antena(s) cujo uso seja autorizado. Para uma lista completa das antenas que têm autorização para serem usadas com o produto, acesse http://www.avaya.com/support.

Avviso! I trasmettitori intenzionali, quali Avaya WLAN Series 2332 Access Point non sono progettati per il funzionamento con antenne di tipo diverso da quello fornito da Avaya. Un trasmettitore intenzionale può funzionare esclusivamente con le antenne per le quali dispone di autorizzazione. Per un elenco completo delle antenne autorizzate per l'uso di questo prodotto, visitare il sito http://www.avaya.com/support.

Warning! All wiring and cables to the Access Point, the surge suppressor and the outdoor antenna should be routed separately. It is particularly important that AC wiring or other outside cabling does not come in contact with the Access Point, antenna cables or interface wiring.

Avertissement! Tous les câblage et câbles au point d'accès, au filtre de montée subite et à l'antenne extérieure devraient être conduits séparément. Il est particulièrement important que le câblage à C.A. ou tout autre câblage d'extérieur n'contacte pas le point d'accès, antenne câble ou câblage d'interface.

Warnung! Alle Verdrahtung und Kabel zum Zugangspunkt, zum Schwankung Entstörer und zur im Freienantenne sollten separat verlegt werden. Es ist, daß Wechselstrom Verdrahtung oder anderes Außenseite Kabeln nicht mit den Zugangspunkt in Berührung kommt, Antenne kabelt oder Schnittstelle Verdrahtung besonders wichtig.

Advertencia! Toda a fiação e cabos ao ponto de acesso, ao supressor de surge e à antena ao ar livre devem ser distribuídos separada. É particularmente importante que a fiação da C. A. ou outro cabografar da parte externa não vêm no contato com o ponto de acesso, antena cabografa ou fiação da relação.

Aviso! Todos os cabos e fiações do Ponto de acesso, do filtro de linha e da antena externa devem ser direcionados separadamente. É especialmente importante que o cabo AC ou qualquer outro cabeamento externo não entrem em contato com o Ponto de acesso, os cabos da antena ou a fiação da interface.

Avviso! Tutto il cablaggio e i cavi diretti al punto di accesso, allo stabilizzatore di corrente e all'antenna esterna devono essere indirizzati separatamente. È estremamente importante che il cablaggio CA o altri cavi esterni non vengano a contatto con il punto di accesso, i cavi dell'antenna o dell'interfaccia.

Earth ground warning

Warning! Earth grounding is required for a WSS installed in a rack. If you are relying on the rack to provide ground, the rack itself must be grounded with a ground strap to the earth ground. Metal screws attaching the switch to the rack provide ground attachment to the rack.

Avertissement ! La mise à la terre est requise pour l'installation du WSS dans un support. Si vous comptez sur le support pour relier l'appareil à la terre, le support doit lui-même être mis à la terre via un conducteur de terre. Le support peut être relié à la terre à l'aide de vis métalliques fixant le commutateur au support.

Warnung! Erdung ist erforderlich für ein WSS, das in einer Buchse installiert ist. Wenn Sie die Erdung durch die Buchse gewährleisten, muss die Buchse selbst mit einem Erdungsband an der Erde geerdet sein. Metallschrauben, mit denen der Schalter an der Buchse befestigt wird, bieten Bodenkontakt für die Buchse.

Advertencia! Se requiere conexión a tierra para un WSS instalado en un soporte. Si cuenta el soporte para que le brinde conexión a tierra, el soporte mismo puede conectarse a tierra con una correa de descarga a tierra. Los tornillos de metal que adhieren el interruptor al soporte le brindan conexión a tierra al soporte.

Aviso! É necessário o aterramento para um WSS instalado em um bastidor. Se você depende do bastidor para o aterramento, o próprio bastidor deve ser aterrado com um fio-terra ao terminal terra. Os parafusos de metal que prendem o switch ao bastidor fornecem aterramento ao bastidor.

Avviso! Per i dispositivi WSS installati su un'intelaiatura è necessario un collegamento con messa a terra. Per poter fornire la messa a terra, l'intelaiatura deve essere dotata di una piattina di massa per il collegamento a terra. Le viti metalliche che collegano l'interruttore all'intelaiatura forniscono il collegamento a terra dell'intelaiatura stessa.

Warning! A properly rated surge suppressor is required for any cable/antenna combination exiting the building. The required components must be rated and approved for use in the intended application.

Avertissement! Un filtre de montée subite correctement évalué est exigé pour n'importe quelle combinaison de cable/antenna sortant le bâtiment. Les composants exigés doivent être évalués et approuvés pour l'usage dans l'application prévue.

Warnung! Ein richtig Nennschwankung Entstörer wird für jede mögliche cable/antenna Kombination angefordert, die das Gebäude herausnimmt. Die erforderlichen Bestandteile müssen für Gebrauch in der beabsichtigten Anwendung steuerpflichtig und anerkannt sein.

Advertencia! Un supresor de oleada correctamente clasificado se requiere para cualquier combinación de cable/antenna que sale del edificio. Los componentes requeridos deben ser clasificados y aprobados para el uso en el uso previsto.

Aviso! Um filtro de linha apropriado é necessário para qualquer combinação de cabo/antena que sai do prédio. Os componentes necessários devem ser avaliados e aprovados para uso na aplicação desejada.

Avviso! per ogni combinazione cavo/antenna in uscita dall'edificio è richiesto uno stabilizzatore di corrente appropriato alla tensione. I componenti necessari devono essere conformi alla tensione richiesta e approvati per l'uso nell'applicazione desiderata.

Warning! Avaya requires that the Access Point in the outdoor enclosure be powered with a Power Over Ethernet (POE) that is supplied only from a Avaya WSS 2350 or WSS 2360/2361 wireless security switch.

Avertissement! Selon les consignes de Avaya, le point d'accès situé dans le boîtier extérieur doit être alimenté par un module PoE (Power over Ethernet) fourni exclusivement par un commutateur de sécurité sans fil Avaya WSS 2350 ou WSS 2360/2361.

Warnung! Bei Avaya muss der Zugriffspunkt im Außengehäuse über Power Over Ethernet (POE) versorgt werden, das nur mit einem Avaya WSS 2350 oder WSS 2360/2361 WLAN-Sicherheitsschalter betrieben werden kann.

Advertencia! De acuerdo con los requisitos de Avaya, el punto de acceso del gabinete externo debe utilizar una conexión eléctrica a través de Ethernet (POE), suministrada sólo por un switch de seguridad inalámbrico WSS 2350 o WSS 2360/2361 de Avaya.

Aviso! A Avaya exige que o Ponto de acesso na caixa externa seja alimentadopor uma Power Over Ethernet (POE) gerada somente a partir de um interruptor de segurança sem fio Avaya WSS 2350 ou WSS 2360/2361.

Avviso! Avaya richiede che il punto di accesso nella struttura esterna sia alimentato mediante tecnologia POE (Power Over Ethernet), fornita solo dai prodotti Avaya WSS 2350 o WSS 2360/2361.

WLAN Series 2332 Outdoor Solution with Indoor Mounted AP

Introduction

This chapter provides the basic outdoor installation instructions for WLAN Series 2332 Outdoor Solution, where the access point is mounted indoors.

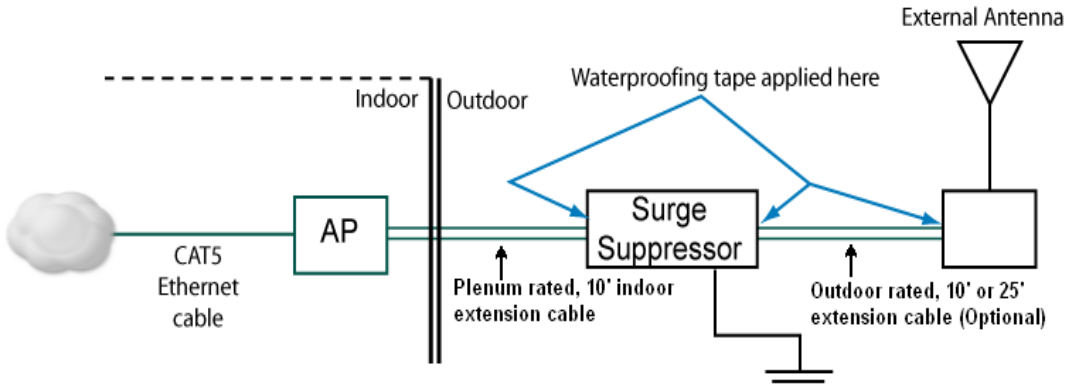
Kit Contents

The WLAN Series 2332 Outdoor Solution with Indoor Mounted AP consists of the following components:

An access point, a surge protector and grounding block, and an external antenna. Figure 1 shows a typical installation.

The access point is mounted indoors and external antennas are typically mounted outdoors, the surge protector and grounding block is installed outdoors at the building entrance. This document describes the solution mounting procedures only.

Figure 1. Avaya WLAN Series 2332 Outdoor Solution with Indoor Mounted AP



Package contents

Table 7. Avaya WLAN Series 2332 Outdoor Solution kits for AP Installed Indoors

Part Number	Kit Components					
DR4011019E5 Phase I Outdoor starter bundle	Surge suppressor	Coax-Seal tape	10 ft RoHS Plenum rated coax cable	1- Male RSMA connector	1- Female RSMA connector	Documentation
DR400085E5 Surge suppressor	Surge suppressor	Coax-Seal tape	Documentation			
DR4018006E5 10 ft. Coax extension	10 ft RoHS Outdoor rated coax cable	Coax seal tape	1- Female RSMA connector	1- Male RSMA connector	Documentation	
DR4018007E5 25 ft. Coax extension	25 ft RoHS Outdoor rated coax cable	Coax seal tape	1- Female RSMA connector	1- Male RSMA connector	Documentation	

Basic outdoor installation information

Signal path distance

In an environment without obstacles in the signal path, the maximum communication distance between antennas depends primarily on the types of antennas, the operating frequency, the data rate and the free space loss between them. Make sure your proposed mounting site provides adequate clearance around the transmitting antenna to enable adequate signal propagation. The WLAN Series 2332 Outdoor Solution supports data rates up to 54 Mbps.

Signal attenuation and loss in outdoor installations

"Appendix" on page 69

Antenna polarization

"Appendix" on page 69

Signal path clearance

A radio beam is intended to travel from one antenna to another in a direct path. Therefore, the path between the antennas must be free of major obstacles. The effects of obstacles and terrain, both along and near the path, have a significant bearing on the propagation of radio signals and can cause both interference and signal degradation.

When choosing a site, consider the effects of the following common obstacles:

- Trees and large plants

A tree directly in the path can completely block the signal. With sufficient clearance above the trees there are usually no secondary effects, but you should allow for future tree growth.

- Man-made obstacles

A large round container such as a gas storage reservoir or water tower that is partially in the path causes some blocking. These obstacles may also reflect some energy, which can interfere with other receivers. Square or rectangular objects in or near the path have rectangular surfaces that can block and diffract signals over and around them.

- Earth surface

The earth surface also interferes with signals if the antenna is mounted too low. Mount the antenna just high enough to allow adequate clearance from the ground. Placing the antenna too high makes it susceptible to interference from other systems.

Physical site survey

Perform a visual inspection of the site to determine and document the physical characteristics of the site and to ensure that all requirements are met for the proper installation and operation of the system.

Contact information and access permissions

Make sure the following general requirements are met before beginning the installation:

- Confirm customer-provided information, such as site contact names and telephone numbers.
- Examine the building (tenant) lease to verify or establish building roof or tower rights. If available, use layout drawings to evaluate the feasibility of modifications or special permits that might be necessary.
- For a tower-mounted installation, find out if the owner, operator, or landlord requires a professional or certified tower climber to do the work.

Physical site

Make sure the following physical site requirements are met before beginning the installation:

- Identify the roof area, wall, or tower for mounting the antenna. You must choose a site with a clear line-of-sight from the transmitting antenna.
- Determine the access area, such as a stairway or a ladder.
- Identify existing equipment installations and assess the condition of proposed towers or mounting structures.
- Assess environmental conditions, such as temperature, ventilation, and humidity.

Warning! Install this device in such a manner as to maintain a minimum of 20 cm (7.9 inches) separation distance between the radiating element(s) and all persons. This safety warning conforms with FCC radio frequency exposure limits.

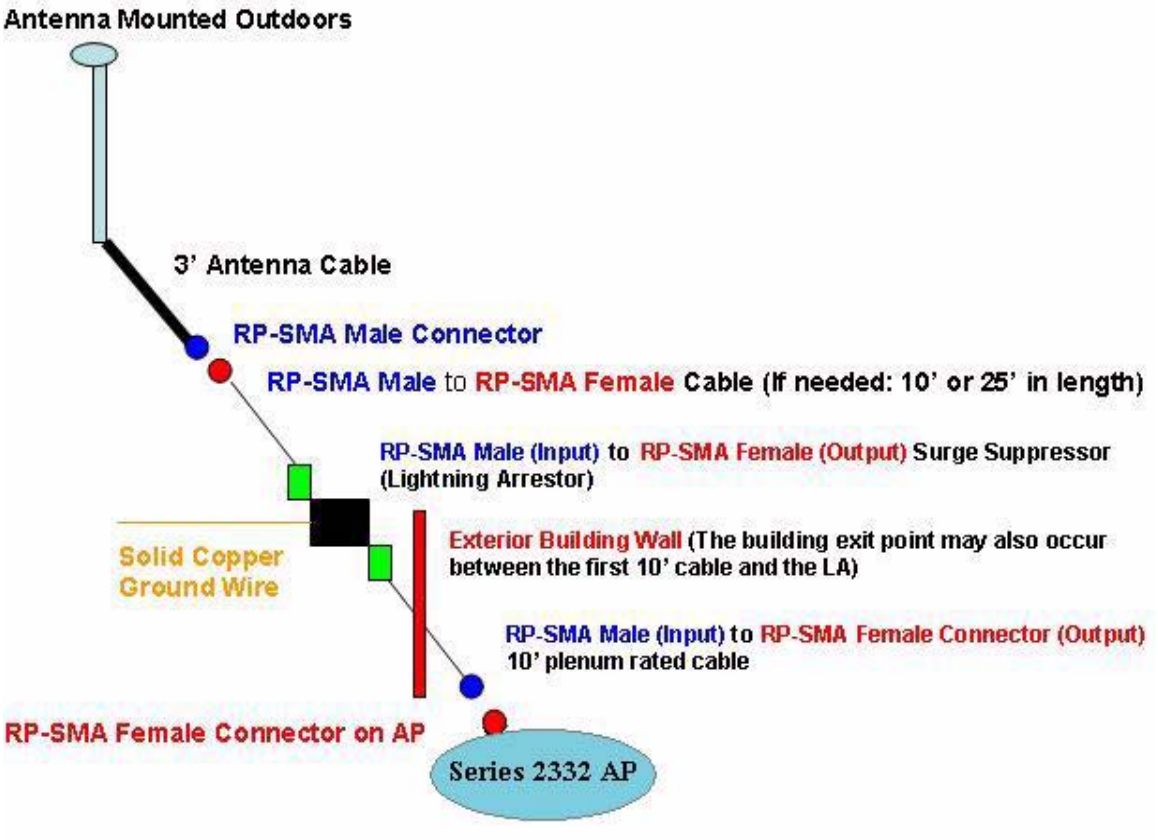
Warning! Intentional radiators, such as the Avaya WLAN Series 2332 Access Points are not intended to be operated with any antenna(s) other than those furnished by . An intentional radiator may only be operated with the antenna(s) with which it is authorized. For a complete listing of the authorized antennas for use with this product, visit http://www.avaya.com/support.

Caution! Do not install the outdoor antenna or connect it to the surge suppressor/Access Point during a storm.

Hardware installation

Required components

Figure 2. Avaya Outdoor External Antenna Supported Connection Configurations


Antenna Mounted Outdoors
3' Antenna Cable
RP-SMA Male Connector
RP-SMA Male to RP-SMA Female Cable (If needed: 10' or 25' in length)
RP-SMA Male (Input) to RP-SMA Female (Output) Surge Suppressor (Lightning Arrestor)
Solid Copper Ground Wire
Exterior Building Wall (The building exit point may also occur between the first 10' cable and the LA)
RP-SMA Male (Input) to RP-SMA Female Connector (Output) 10' plenum rated cable
RP-SMA Female Connector on AP
Series 2332 AP

Outdoor external antenna connection scenarios

There are three basic connection scenarios that are supported for implementing the Avaya WLAN Series 2332 Outdoor Solution. These are described in the following table:

Table 8. Avaya WLAN Series 2332 Outdoor Solution configuration scenarios

Scenario 1	Scenario 2	Scenario 3
Configuration consists of the Series 2332 AP connected to a 10-foot plenum rated cable, which in turn is connected to a Surge Suppressor and then is connected to one of the outdoor rated antennas	Configuration consists of the Series 2332 AP connected to a 10-foot plenum rated cable, which in turn is connected to a Surge Suppressor, which in turn is connected to a 10-foot outdoor rated extension cable and then is connected to one of the outdoor rated antennas.	Configuration consists of the Series 2332 AP connected to a 10-foot plenum rated cable, which in turn is connected to a Surge Suppressor, which in turn is connected to a 25-foot outdoor rated extension cable and then is connected to one of the outdoor rated antennas.

Based on these three scenarios, the following tables illustrate the additional amount of power loss that will be realized when the extra cables and components are used to enable the access point to be mounted indoors and the radiating element (i.e. antenna) to be mounted on the exterior of the premises. These additional losses need to be factored into the overall system path loss equation when selecting placement of the access points and net coverage areas. The current implementation of the WSS and WMS software does not allow for optimization of performance by increasing the transmitter's output power to compensate for the added loss. That feature will be available in a subsequent release of the WSS and WMS software. The values listed in the following tables can be used to estimate a net reduction in total system power and coverage area.

For reference, a 3 dB reduction in power equates to halving the effective linear power. This translates to a reduction in available range of a factor of four times. An additional loss of 3 dB would halve the power again and reduce the range by another factor of four times. Hence, care should be taken to place the access point as near to the point of debarkation from the premises as possible to reduce signal loss and optimize the outdoor coverage area.

Table 9. Loss associated with 10-foot plenum rated cable and surge suppressor

Connects AP to Surge Suppressor	Plenum Rated Cable (RG-58)					
Component	10 ft Cable		Surge Suppressor		10 ft Cable + Surge Suppressor	
Frequency (MHz)	Loss (dB)	Loss (linear)	Loss (dB)	Loss (linear)	Loss (dB)	Loss (linear)
2400 - 2500	-2.89	0.486	-0.13	0.029	-3.02	0.501
5150 - 5250	-4.96	0.681	-0.40	0.087	-5.36	0.709
5250 - 5350	-5.00	0.684	-0.38	0.083	-5.38	0.710
5470 - 5725	-5.23	0.700	-0.47	0.103	-5.70	0.731
5725 - 5850	-5.30	0.705	-0.57	0.123	-5.87	0.741

Table 10. Loss associated with 10-foot and 25-foot outdoor rated extension cables

Connects surge suppressor to Antenna	Outdoor Cable (LMR-240)			
Component	10 ft Cable		25 ft Cable	
Frequency (MHz)	Loss (dB)	Loss (linear)	Loss (dB)	Loss (linear)
2400 - 2500	-1.84	0.345	-3.89	0.591
5150 - 5250	-2.68	0.460	-5.70	0.731
5250 - 5350	-2.79	0.474	-5.81	0.737
5470 - 5725	-2.78	0.473	-5.91	0.743
5725 - 5850	-2.81	0.476	-5.93	0.745

The following table summarizes the net effective loss for the three connection scenarios outlined above. In general, for the 2.4 GHz operating frequency band, Scenario 1 will have an additional loss of 3.0 dB, Scenario 2 will have an additional loss of 4.9 dB and Scenario 3 will add a loss of 6.9 dB.

Table 11. Summary of loss for three scenarios

	Outdoor Combinations					
Configuration	Scenario 1		Scenario 2		Scenario 3	
Frequency (MHz)	Loss (dB)	Loss (linear)	Loss (dB)	Loss (linear)	Loss (dB)	Loss (linear)
2400 - 2500	-3.02	0.501	-4.86	0.673	-6.91	0.796
5150 - 5250	-5.36	0.709	-8.04	0.843	-11.06	0.922
5250 - 5350	-5.38	0.710	-8.17	0.847	-11.18	0.924
5470 - 5725	-5.70	0.731	-8.48	0.858	-11.61	0.931
5725 - 5850	-5.87	0.741	-8.68	0.865	-11.81	0.934

Surge suppressor (lightning arrestor)

The series gas-discharge surge suppressors (lightning arresters) provide high-level protection for transmitters and receives at RF-communication sites. In the event of a local strike, the unit's gas discharge tube ionizes instantaneously to limit sudden voltage surges across the coaxial line. When connected to a satisfactory ground, the unit can safely shunt up to 5000 Amps of impulse current away from sensitive station equipment.

Warning! A properly rated surge suppressor is required for any cable/antenna combination exiting the building. The required components must be rated and approved for use in the intended application.

Figure 3. Surge suppressor

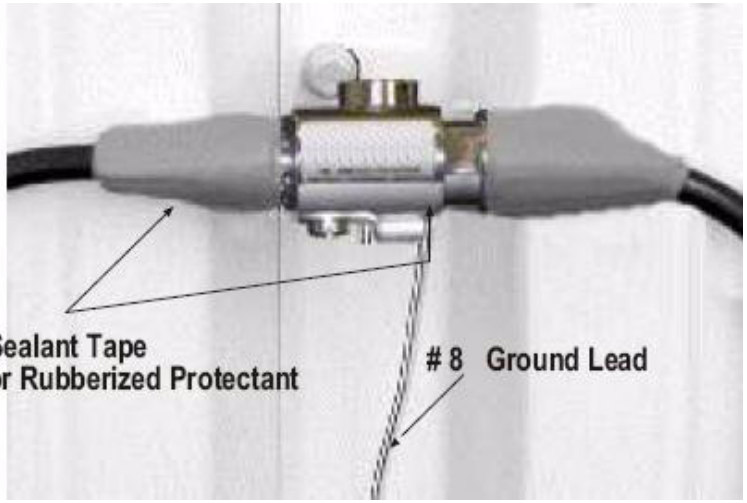
Installation

For best results, install the surge suppressor in close proximity to a low-resistance ground at a point where the coaxial cable enters the building. In most cases, one 8-foot rod driven into moist soil or multiple rods bonded together will provide adequate grounding. (see National Electrical Code guidelines).

Install the surge suppressor in an accessible location that allows for periodic inspection and possible replacement of the gas cartridge. Provide drip loops in the cables to prevent water from entering the building, see (Figure 6 on page 49).

The life expectancy of the replaceable gas tube depends on the frequency and severity of electrostatic activity at the site. Low-level conduction resulting from near-by storm activity has very little impact on the life of the cartridge, but powerful surges induced by on-site strikes will eventually result in degraded performance or failure. Degraded performance indicators include reduced receiver sensitivity, above normal VSWR readings, and RF heating of the surge suppressor body during transmit mode. Should the discharge tube fail totally, it becomes a permanently conductive protective shunt to ground. Periodic SWR checks provide a good indicator of deteriorating performance, and routine replacement may be indicated following especially severe weather events where multiple on-site strikes were known to have happened.

Figure 4. #8 Ground lead



Grounding principles

To connect the surge suppressor to ground, use the shortest and most direct run possible with #8 solid copper wire (or equivalent). For exterior installations, weatherproof the coax connectors with a suitable mastic or rubberized tape to prevent water infiltration. (see Figure 4 on page 48).

Warning! All wiring and cables to the Access Point, the surge suppressor and the outdoor antenna should be routed separately. It is particularly important that AC wiring or other outside cabling does not come in contact with the Access Point, antenna cables or interface wiring.

Caution! The power source equipment connected to the Access Point, such as the Wireless Security Switch or PoE injector, must be provided with a reliable earth ground to insure safety of the system.

Figure 5. Typical installation diagram

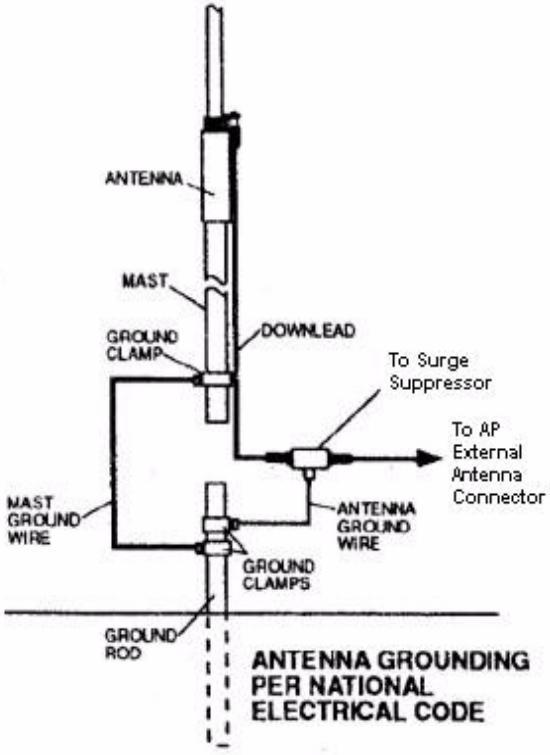
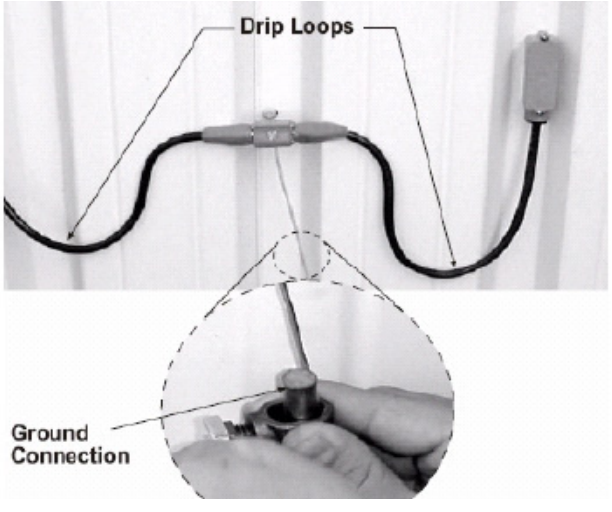


Figure 6. Drip Loops



Note. A good ground system is essential for proper operation.

Warning! A properly rated surge suppressor is required for any cable/antenna combination exiting the building. The required components must be rated and approved for use in the intended application.

Outdoor external antennas

This section introduces the outdoor external antenna portfolio available for the WLAN Series 2332 Access Points. The portfolio includes 802.11b/g (2.4 GHz) and 802.11a (5.0 GHz) models for outdoor use. The addition of outdoor external antennas to the WLAN Series 2332 System portfolio improves overall system value:

- Improved deployment flexibility - Planners can choose an antenna pattern that meets coverage requirements while allowing for convenient AP placement and installation.
- Improved coverage and performance - External antennas allow planners to optimize coverage and deliver higher available data rates to user concentrations.
- Can provide a low cost fix for trouble spots - Appropriately outfitting existing APs with external antennas can greatly improve coverage and available data rates in areas that are not adequately serviced.
- Lower cost of coverage - External antennas improve overall system efficiency by effectively directing available energy to where it's needed. This ensures overall system utility is maximized for any installation.

The WLAN Series 2332 outdoor external antennas are the only external antennas certified by for use with WLAN Series 2332 systems. WLAN Series 2332 Access Points that are outfitted with non-certified outdoor external antennas are not supported under support agreements.

The WLAN Series 2332 system must be upgraded to WSS Software Release 6.0.6.2 or later and WMS Software Release 6.0.7.1 or later. This upgrade includes antenna pattern libraries for the WLAN Series 2332 outdoor external antenna portfolio and allows the system to:

- Compensate for extension cable loss and lightning protection circuitry that is essential for operation in an outdoor environment.
- Correctly interpret received signal strength measurements from APs with external antennas when calculating rogue device or client location.

The WLAN Series 2332 System outdoor external antenna portfolio is sourced from Cushcraft, a world leader in the development of advanced antenna technology and products.

- The Cushcraft products have been modified for compatibility with the Series 2332 Access Points
- versions are equipped with an R-SMA type connector to comply with 's quality and regulatory standards and correctly interface with the Series 2332 Access Points.
- The Cushcraft model numbers presented throughout this bulletin refer to the specific versions and may not exactly match similar versions promoted on Cushcraft's website or other product materials.

- has tested and measured each product. The antenna gains expressed in dBi measurements are the tested values and may differ slightly from those published by Cushcraft for similar products.

Coax cable seal installation

Applying coax seal tape

You must weather seal all outside coaxial connections using the coax seal tape provided in the mounting kit. Coax connections that are not properly sealed permit moisture to enter the connection, which leads to performance degradation or link problems.

Note. Do not use plastic or vinyl electrical tape on the connectors because it will deteriorate during long-term exposure to ultraviolet light and extreme weather.

To apply the coax seal tape, follow these steps:

1. Make sure that the coaxial cables, connectors, and the connector area are clean and dry.
2. Peel the paper backing from a length of coax seal tape.
3. Wrap each connector with the coax seal tape, starting at the coaxial cable, extending across the connector body, and finishing close the lightning arrestor surge suppressor or grounding block. Overlap each turn at least 50 percent so there is a double thickness over all areas. See Figure 7 on page 51.

Figure 7. Applying the coax seal tape before smoothing.

Use your fingers to mold and form the coax seal tape around the cable and connector to form a smooth, neat surface. Be sure to squeeze out any air pockets. See Figure 8 on page 52

Figure 8. Coax seal tape after smoothing.

4 Visually inspect the seal to make sure the entire connector area is completely covered. If you find gaps, apply additional Coax-Seal over the existing material and then mold it to shape

5 Repeat these steps for each coaxial connection outside.

Physical site survey

Perform a visual inspection to determine and document the physical characteristics of the site and to ensure that all requirements are met for the proper installation and operation of the system.

Physical site

Make sure the following requirements for your physical site are met before beginning the installation:

- Identify the roof area, wall, or tower for mounting the solution. You must choose a site with a clear line-of-sight from the transmitting antenna.
- Determine the access area, such as a stairway or a ladder.
- Identify existing equipment installations and assess the condition of proposed towers or mounting structures.

Assess environmental conditions, such as temperature, ventilation, and humidity.

Cable routes

Make sure the following cable route requirements are met before beginning the installation:

- Determine cable routes, building entry points, and any special routing or support requirements (conduits, bracing, cable trays, safety structures, and so on). Make sure the total cable length between the access point and the wireless security switch is no greater than 100 meters.
- Identify necessary floor, roof, or wall penetrations and specify the locations.
- Document existing grounding system and connection requirements for new equipment.
- Refer to these electrical codes for your local regulations:
    - NFPA 70 (US National Electrical Code)
    - Canadian Electrical Code, Part1, CSA 22.1

IEC 364, Part 1 through 7 for other countries

Software installation

Country of operation

Before you can configure APs and radio parameters, you must specify the country in which you plan to operate the radios. Since each country has different regulatory environments, the country code determines the transmit power levels and channels you can configure on the radios. WSS software ensures that the values you can configure are valid for the country you specify.

You must specify the country in which you plan to operate the WSS and its APs. WSS software does not allow you to configure or enable the AP radios until you specify the country of operation

The country code is one of the parameters you set when you create a network plan. Be sure to select the country code for the country in which the AP will be operated. It is a violation of regulatory laws to set the country code to a country that is different than the actual country in which the AP is operating.

For a complete listing of the two-letter country codes, refer to the "Approved Countries for the WLAN Series 2332 Components" at http://www.avaya.com/support.

Use of external antenna configuration option CLI and WMS

Specifying the external antenna model

To specify the 2.4 GHz external antenna model using CLI, use the following command:

set {**ap** *port-list* | **dap** *dap-num*} **radio** {**1** | **2**} **antennatype {internal | 24143 | 24123 | 24113 | 24203 | 24403 | 24453 | 24493 | 24553 | 24883 | mixed | 24143-OUT | 24143-OUT-10 | 24143-OUT-25 | 24143-NEMA | 24143-NEMA-10 | 24143-NEMA-25 | 24123-OUT | 24123-OUT-10 | 24123-OUT-25 | 24123-NEMA | 24123-NEMA-10 | 24123-NEMA-25 | 24113-OUT | 24113-OUT-10 | 24113-OUT-25 | 24113-NEMA | 24113-NEMA-10 | 24113-NEMA-25 | 24493-OUT | 24493-OUT-10 | 24493-OUT-25 | 24493-NEMA | 24493-NEMA-10 | 24493-NEMA-25 | 24883-OUT | 24883-OUT-10 | 24883-OUT-25 | 24883-NEMA | 24883-NEMA-10 | 24883-NEMA-25}**

To specify the 5.0 GHz external antenna model using CLI, use the following command:

set {**ap** *port-list* | **dap** *dap-num*} **radio** {**1** | **2**} **antennatype {internal | 5133 | 5303 | 5643 | 5173 | 5103 | mixed | 5133-OUT | 5133-OUT-10 | 5133-OUT-25 | 5133-NEMA | 5133-NEMA-10 | 5133-NEMA-25 | 5643-OUT | 5643-OUT-10 | 5643-OUT-25 | 5643-NEMA | 5643-NEMA-10 | 5643-NEMA-25 | 5173-OUT | 5173-OUT-10 | 5173-OUT-25 | 5173-NEMA | 5173-NEMA-10 | 5173-NEMA-25 | 5103-OUT | 5103-OUT-10 | 5103-OUT-25 | 5103-NEMA | 5103-NEMA-10 | 5103-NEMA-25}**

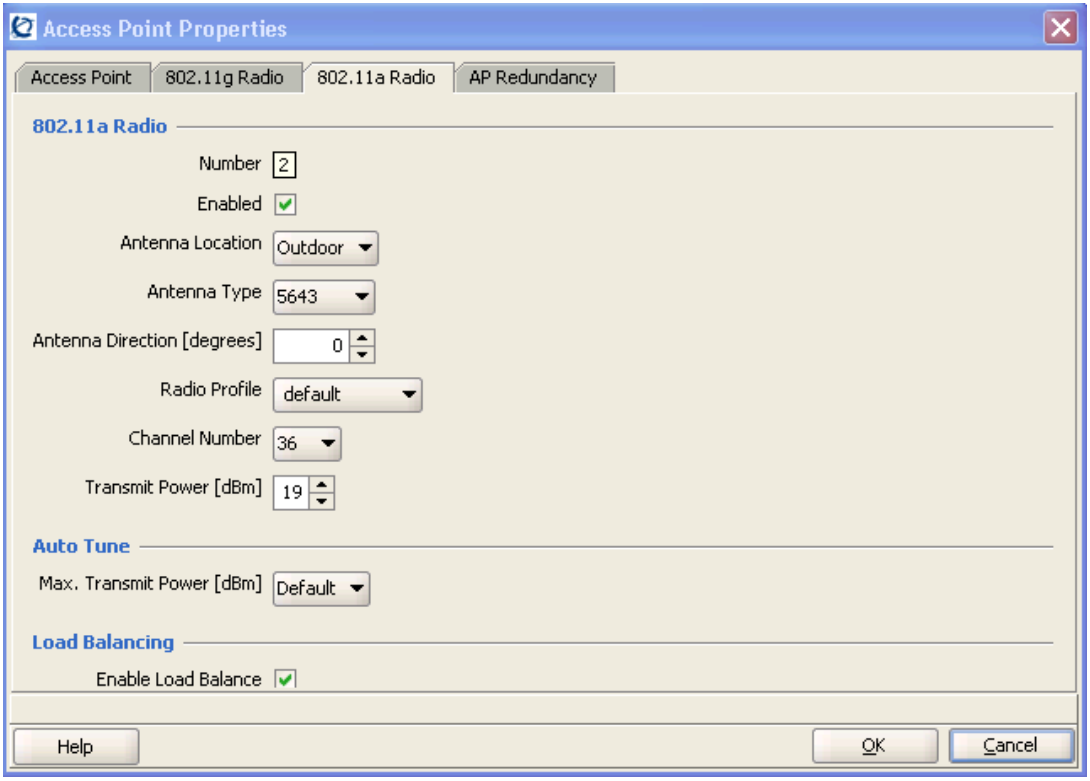
Note. The options displayed are dependent upon the access point model number that this CLI command is executed against. The following example is for an Access point 2332-A1.

To configure antenna model 5643-OUT-10 for a 2332-A1 on Distributed AP 1, type the following command:

WSS# **set dap 1 radio 1 antennatype 5643-OUT-10**
success: change accepted.

To specify the external antenna model using WMS, use the AP Configuration menu and fill in the required information.

Figure 9. WMS AP external antenna configuration



Other related documentation references

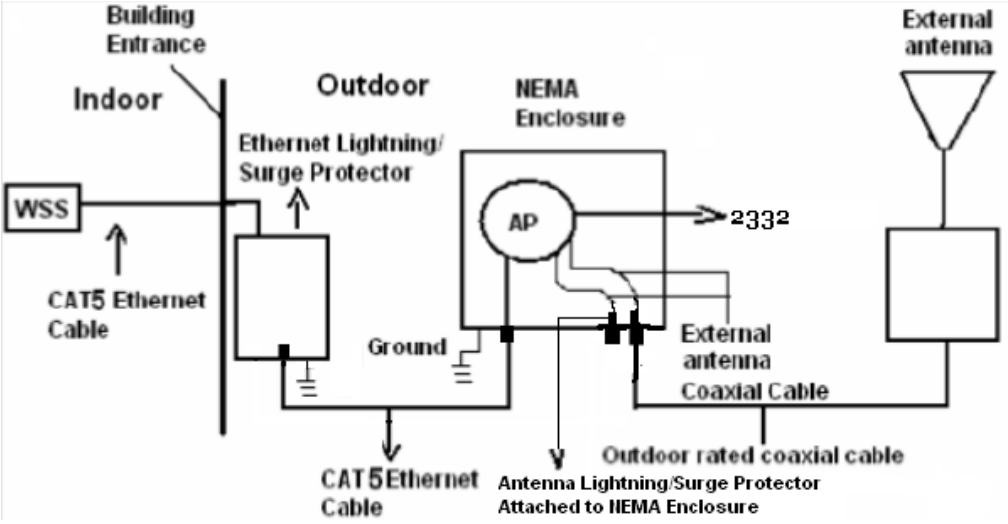
- *WLAN—Management System 2300 Series Reference Manual*. Instructions for planning, configuring, deploying, and managing the entire WLAN with the WLAN Management System tool suite
- *WLAN—Security Switch 2300 Series Configuration Guide*. Instructions for configuring and managing the system through the WSS software CLI
- *WLAN—Security Switch 2300 Series Command Line Reference.* Functional and alphabetic reference to all WSS software commands supported on WSSs and APs
- *WLAN—Series 2332 Access Point Installation Guide*. Instructions for planning, configuring, deploying, and managing the access points.

WLAN Series 2332 Outdoor Solution with AP Mounted in NEMA Enclosure

Introduction

This chapter provides the NEMA Enclosure Installation Instructions for the WLAN Series 2332 Outdoor Solution, where the AP is mounted outdoors.

Figure 10. Avaya WLAN Series 2332 Outdoor Solution

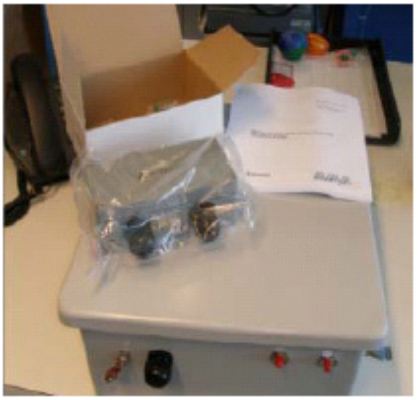


Kit Contents for Series 2332 AP installed outdoors in NEMA Enclosure

The kit consists of the following components:

- Series 2332 Access Point in separate box
- ODS NEMA enclosure
- Ethernet lightning Surge Suppressor
- Installation document

Figure 11. Kit Contents of the NEMA Outdoor Solution



Site Planning

Perform a visual inspection to determine and document the physical characteristics of the site.

Ensure that the Site Planning meets the following requirements before you begin the installation:

- Identify the roof area, wall, or tower for mounting the Outdoor Solution.
- Choose a site with a clear line-of-sight from the transmitting antenna.
- Determine the access area, such as a stairway or a ladder.
- Identify existing equipment installations and assess the condition of proposed towers or mounting structures.
- Assess environmental conditions, such as temperature, ventilation, and humidity.

Ethernet

The AP must be <100 meters from the WSS (WLAN Security Switch).

Note. Avaya recommends using outdoor CAT5E Ethernet Cable for all external connections.

Antenna

Ensure that antennas have advanced deployment flexibility, coverage, and performance.

This implies that planners should choose:

- An antenna pattern that meets coverage requirements while allowing for convenient AP placement and installation.
- Antennas that optimize the coverage pattern and deliver higher available data rates to user concentrations.

- Coverage pattern and available data rates in areas that are not adequately serviced.
- Overall system efficiency by effectively directing available energy to where it's needed.
- System utility for any installation.

The WLAN Series 2332 outdoor external antennas are the only external antennas certified by Avaya for use with WLAN Series 2332 systems. WLAN Series 2332 Access Points that are outfitted with non-certified outdoor external antennas are not supported under Avaya support agreements.

The WLAN Series 2332 system must be upgraded to WSS Software 6.0.6.2 or later and WMS 6.0.7.1 or later. This upgrade includes antenna pattern libraries for the WLAN Series 2332 outdoor external antenna portfolio and allows the system to:

- Compensate for extension cable loss and lightning protection circuitry that is essential for operation in an outdoor environment.
- Correctly interpret received signal strength measurements from APs with external antennas when calculating rogue device or client location.

The WLAN Series 2332 System outdoor external antenna portfolio is sourced from Cushcraft, a world leader in the development of advanced antenna technology and products.

- The Cushcraft products have been modified for compatibility with the Series 2332 Access Points.
- Avaya versions are equipped with an R-SMA type connector to comply with Avaya's quality and regulatory standards and correctly interface with the Series 2332 Access Points.
- The Cushcraft model numbers presented throughout this bulletin refer to the Avaya specific versions and may not exactly match similar versions promoted on Cushcraft's website or other product materials.
- Avaya has tested and measured each product. The antenna gains expressed in dBi measurements are the Avaya tested values and may differ slightly from those published by Cushcraft for similar products.

Note. Only use Avaya approved antennas with the Series 2332 Access Points.

Safety Precautions

In this section Powerline and Installation safety precautions are provided.

Powerline

- Coming in contact with power lines can be lethal.
- Ensure that there are no accessible power lines near the installation site to avoid accidental or incidental human contact with these lines.
- Ensure that antennas, masts, towers, guy wires or cables cannot come into contact with these powerlines. Try to plan for potential leaning or falling of this equipment into these lines.
- You may get injured or killed if you are touching or holding any part of equipment when it contacts electric power lines.
- Ensure there is NO possibility that equipment or personnel can come in contact directly or indirectly with power lines.

- If anything, such as a wire or mast, does come in contact with a powerline, **DO NOT TOUCH IT OR ATTEMPT TO MOVE IT.** Call the power company.
- Do not attempt to errect antennas or towers on windy days.

Installation

- The horizontal distance from a tower, mast or antenna to the nearest power line should be at least twice the total length of the mast/antenna combination. This will ensure that the mast will not contact the power line if it falls either during installation or later.
- Make sure that all towers and masts are securely grounded and electric cables connected to antennas have lightning protection. This will help to prevent fire damage or human injury in case of lightning, static build-up, or short circuit when equipment is connected to the antenna.

Heat/Cold loading

The NEMA Enclosure environment must not exceed the operating specifications for the AP (Series 2332). Temperature must be between 0 to 50 degrees C and humidity between 10 to 95%, non condensing.

Reference Information

The following section describes the Ethernet Lightning Surge Protector, Terminal Strip Connection, Coax cable seal Installation, and Antennas.

Ethernet and Antenna Lightning Surge Protector

The Avaya series gas-discharge Antenna surge Protector (lightning protector) provides high-level protection for transmitters and receivers at RF-communication sites. In the event of a local strike, the unit's gas discharge tube ionizes instananeously to limit sudden voltage surges across the coaxial line. When connected to a satisfactory ground, the unit can safely shunt up to 5000 Amps of impulse current away from sensitive station equipment.

Warning! A rated surge Protector is required for any cable/antenna combination exiting the building. The required components must be rated and approved for use in the intended application.

Installation

The Ethernet Lightning Surge Protector is mounted close to the building entrance. The cables must enter the building through customer provided access, possibly through the drilled hole where there are communications pipes.

For better results, install the Lightning Surge Protector in close proximity to a low-resistance ground at a point where the Ethernet cable enters the building. In most cases, one 8-foot rod driven into moist soil or multiple rods bonded together will provide adequate grounding.

Install the Lightning Surge Protector in an accessible location that allows for periodic inspection. Provide drip loops in the cables to prevent water from entering the building.

Grounding principles

To connect the Surge Protector to ground, use the shortest and most direct run possible with #8 solid copper wire (or equivalent).

Refer to your local electric code standards for correct installation.

Applying coax seal tape

For applying Coax seal tape refer:

See “Coax cable seal installation” page 51

Installation of Series 2332 Access Points

In this section you will find instructions on installing the Series 2332 Access Points in an outdoor mounted enclosure.

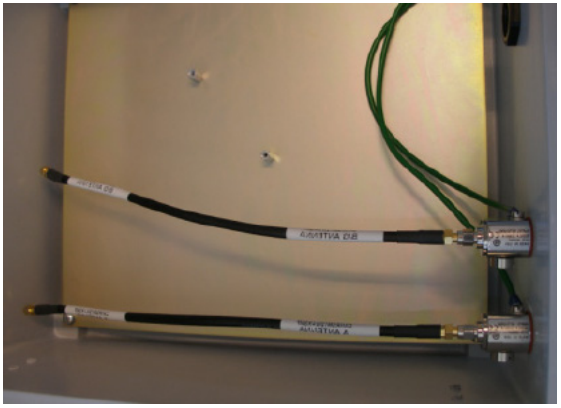
Installation of the NEMA Enclosure

1 Remove the NEMA Enclosure from the ODS kit and place it on a flat surface near the installation location. The following figure shows the enclosure connections from left to right: ground lug, Ethernet Gland, and two external antenna connectors.

Figure 12. NEMA Enclosure

2 Open the enclosure cover by pushing the latches down on the side and lifting the cover up.

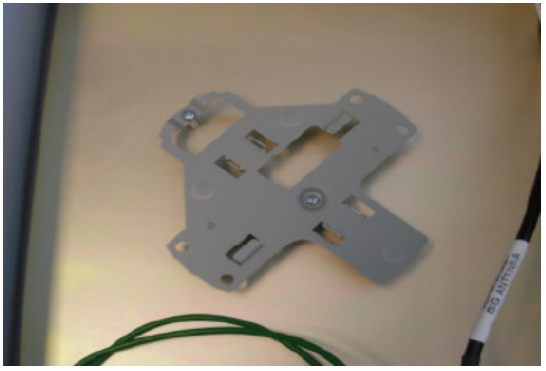
Figure 13. External Antenna cables in the Enclosure



3 Obtain the AP mounting bracket from the AP kit.

4 Use two 6/32 screws to secure the mounting bracket to the standoffs in the enclosure as shown in Figure 14

Figure 14. Mounting Bracket



5 Unscrew the Ethernet Gland nut on the outside of the enclosure.

6 Remove the split rubber washers from the Ethernet Gland nut.

7 Slide the Ethernet Gland nut onto the Ethernet cable.

Make sure the threaded end is facing the Ethernet cable connector on the enclosure.

8 Slide the rubber washers onto the Ethernet cable.

The rubber washers and gland nut on the Ethernet cable are shown in Figure 15 .

Figure 15. Rubber Washers into the Ethernet cable

9 Insert enough of the Ethernet cable into the enclosure so that you can connect it to the AP.

10 Tighten the Gland nut, but not 100%. Tighten it just enough to ensure it stays in place.

11 Loop the Ethernet cable through the mounting bracket as shown in Figure 16 .

Figure 16. Ethernet cable in the Mounting Bracket

12 Connect the Ethernet cable to Port 1 on the AP as shown in Figure 17

Figure 17. Connecting Ethernet cable to Port 1

13 Connect the external antenna cables to the AP as shown in Figure 18 .

11A Antenna cable connects to top connector.

11BG Antenna cable connects to bottom connector.

Figure 18. Connecting external antenna cables to the AP

14 Use a 5/16 wrench to tighten the external antenna connectors to the recommended specifications.

Note. Be careful not to over-tighten the coaxial cable connections. Damage to the AP may result if too much torque is applied to the connection.

15 Attach AP to the AP mounting bracket.

16 From AP side opposite of Antenna connections, find location to lock Mounting plate.

For more information about Installation of Mounting Plate, refer to the Avaya WLAN Series 2332 Access Point Installation Guide.

17 Use AP mounting tool(nail) to lock the AP to the bracket.

18 Secure Cover on the enclosure.

19 Complete tightening of the Ethernet Gland nut.

20 Mount the NEMA enclosure with appropriate mounting hardware that supports the ODS NEMA Enclosure.

21 Ground the enclosure by attaching the ground cable to the ground lug according to Local Electrical Code.

22 Attach external antennas to NEMA Enclosure with Avaya approved cable.

Installation of the Ethernet Lightning Surge Protector

1 Obtain the Ethernet Lightning Surge Protector from the Kit.

2 Remove the cover of the Ethernet Lightning Surge Protector.

3 Unscrew the Ethernet Gland nut on the left side of the Ethernet Lightning Surge Protector.

4 Remove the rubber washers from the Ethernet Gland.

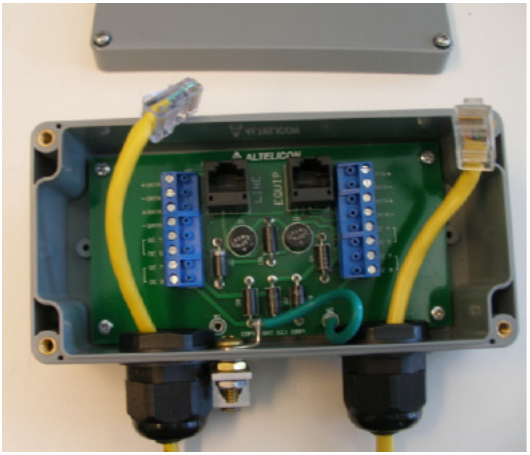
5 Slide the Ethernet Gland nut onto the Ethernet cable.

Make sure the threaded end is facing the Ethernet cable connector on the enclosure.

6 Slide the rubber washers onto the Ethernet cable.

7 Insert the Ethernet cable into the Ethernet Lightning Surge Protector and connect it to the connector labeled LINE as shown in Figure 19 .

Figure 19. Connecting Ethernet Lightning Surge Protector to the Connector



8 Tighten the Ethernet Gland nut.

9 Connect the Ethernet cable to the WLAN Security Switch (WSS).

10 Unscrew the Ethernet Gland nut on the right side of the Ethernet Lightning Surge Protector.

11 Remove the rubber washers from the Ethernet Gland.

12 Slide the Ethernet Gland nut onto the Ethernet cable.

Make sure the threaded end is facing the Ethernet cable connector on the enclosure.

13 Slide the rubber washers onto the Ethernet cable.

14 Connect the Ethernet cable to the Ethernet Lightning Protector connector labeled EQUIP.

15 Tighten the Ethernet Gland nut.

16 Replace the cover of the Ethernet Lightning Surge Protector.

17 Mount the Ethernet Lightning Surge Protector with the appropriate hardware available in the kit.

Refer to the Mounting instructions in the box.

For more Information about the Mounting of the Ethernet Surge Protector refer Appendix.See “Surge suppressor (lightning arrestor)” page 46

18 Ground Ethernet Lightning Surge Protector by attaching Ground cable to Ground lug according to local electric code

Terminal Strip Connection

You can use terminal strips if you do not have RJ 45 jack connectors.

To use Terminal Strip perform the following steps:

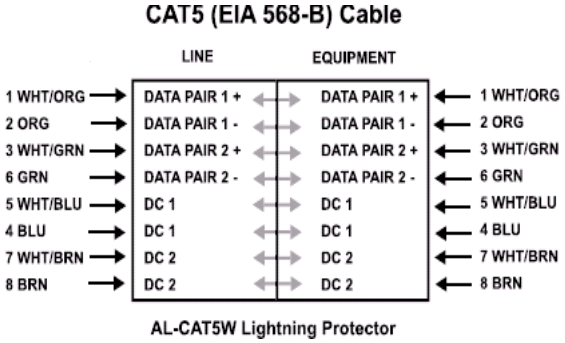
1 Install the data cable through the strain relief.

2 Strip back cable jackets.

3 Terminate the data wires to the screw down terminal blocks.

To pin out the Terminal strips refer Figure 20 .

Figure 20. Terminal Strip Connection



Warning! Avaya requires that the Access Point in the outdoor enclosure be powered with a Power Over Ethernet (POE) that is supplied only from an Avaya WSS 2350 or WSS 2360/2361 wireless security switch.

Software

Country of operation

Before you can configure APs and radio parameters, you must specify the country in which you plan to operate the radios. Since each country has different regulatory environments, the country code determines the transmit power levels and channels you can configure on the radios. WSS Software ensures that the values you can configure are valid for the country you specify.

You must specify the country in which you plan to operate the WSS and its APs. WSS Software does not allow you to configure or enable the AP radios until you specify the country of operations.

The country code is one of the parameters you set when you create a network plan. Be sure to select the country code for the country in which the AP will be operated. It is a violation of regulatory laws to set the country code to a country that is different than the actual country in which the AP is operating.

For a complete listing of the two-letter country codes, refer to the "Approved Countries for the WLAN Series 2332 Components" at http://www.avaya.com/support.

To specify the 2.4 GHz external antenna model using CLI, use the following command:

set {ap *port-list* **| dap** *dap-num*} **radio {1 | 2} antennatype** {internal | 24143 | 24123 | 24113 | 24203 | 24403 | 24453 | 24493 | 24553 | 24883 | mixed | 24143-OUT | 24143-OUT-10 | 24143-OUT-25 | 24143-NEMA | 24143-NEMA-10 | 24143-NEMA-25 | 24123-OUT | 24123-OUT-10 | 24123-OUT-25 | 24123-NEMA | 24123-NEMA-10 | 24123-NEMA-25 | 24113-OUT | 24113-OUT-10 | 24113-OUT-25 | 24113-NEMA | 24113-NEMA-10 | 24113-NEMA-25 | 24493-OUT | 24493-OUT-10 | 24493-OUT-25 | 24493-NEMA | 24493-NEMA-10 | 24493-NEMA-25 | 24883-OUT | 24883-OUT-10 | 24883-OUT-25 | 24883-NEMA | 24883-NEMA-10 | 24883-NEMA-25}

To specify the 5.0 GHz external antenna model using CLI, use the following command:

set {ap *port-list* **| dap** *dap-num*} **radio {1 | 2} antennatype** {Internal | 5133 | 5303 | 5643 |5173 | 5103 | mixed | 5133-OUT | 5133-OUT-10 | 5133-OUT-25 | 5133-NEMA | 5133-NEMA-10 | 5133-NEMA-25 | 5643-OUT | 5643-OUT-10 | 5643-OUT-25 | 5643-NEMA | 5643-NEMA-10 | 5643-NEMA-25 | 5173-OUT | 5173-OUT-10 | 5173-OUT-25 | 5173-NEMA | 5173-NEMA-10 | 5173-NEMA-25 | 5103-OUT | 5103-OUT-10 | 5103-OUT-25 | 5103-NEMA | 5103-NEMA-10 | 5103-NEMA-25}

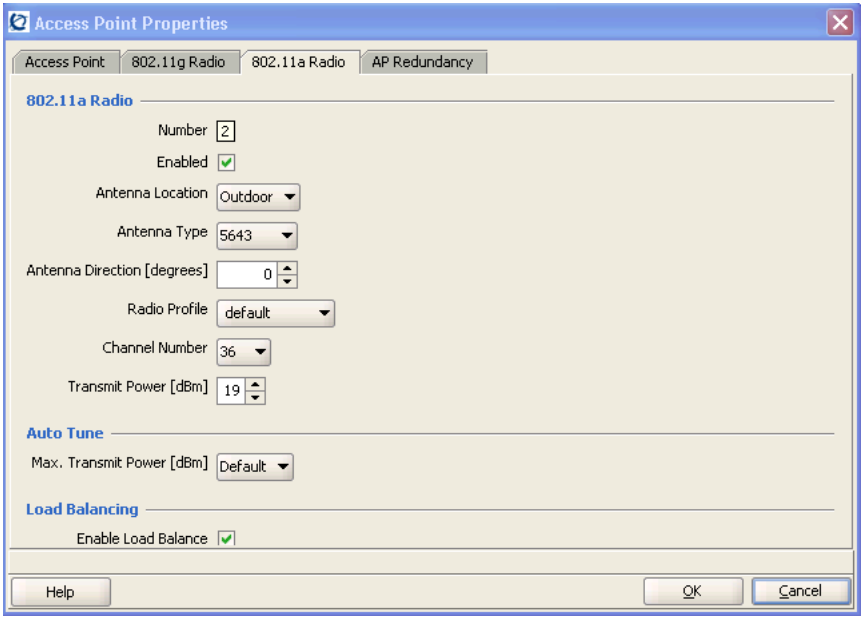
Note. The options displayed are dependent upon the access point model number that this CLI command is executed against. The following example is for a 2332-A1 Access Point.

To configure antenna model 5643-OUT-10 for a 2332-A1 on Distributed AP 1, type the following command:

WSS# set dap 1 radio 1 antennatype 5643-OUT-10

To specify the external antenna model using WMS, use the AP Configuration menu and fill in the required information refer Figure 21 .

Figure 21. Configuring an Antenna



Appendix

Supported antenna information

Outdoor external antenna options

The outdoor external antenna WSS model string relates directly to the base external antenna being used in the connection scenarios outlined previously.

For example, WSS model string 24493-OUT would imply a configuration that includes the 10-foot plenum-rated R-SMA (M) to R-SMA (F) indoor RoHS compliant cable, the surge suppressor (DR4000085E5) and the S2403BPXN36RSM antenna (DR4000088E6). Additionally, WSS model string 24493-OUT-10 would include the 10-foot plenum-rated R-SMA (M) to R-SMA (F) indoor RoHS compliant cable, the lightning arrester (DR4000085E5), the 10-foot R-SMA (F) to R-SMA (M) OUTDOOR LMR-240, RoHS compliant cable (DR4018006E5) and the S2403BPXN36RSM antenna (DR4000088E6).

The following table lists the outdoor accessories associated with constructing the connection scenarios outlined previously:

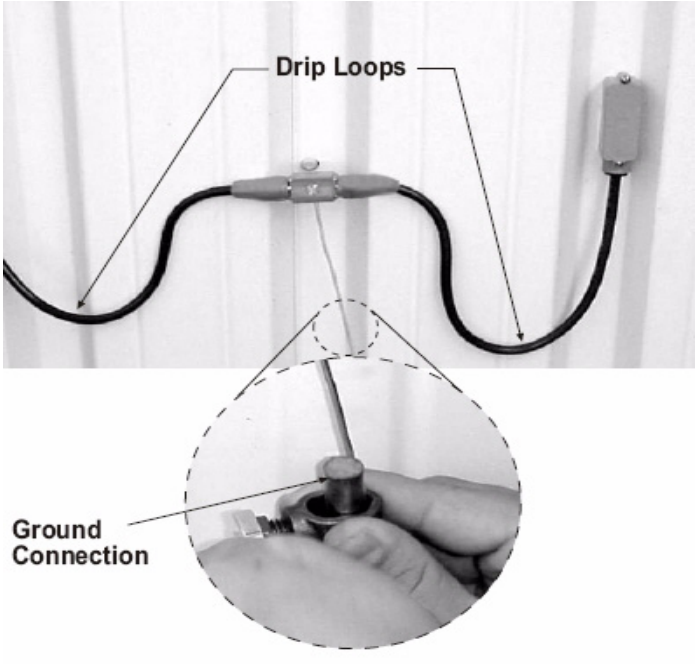
Table 12: Outdoor accessories

Cushcraft P/N	Avaya P/N	Description
LAC6NRSMMF	DR4000085E5	Surge suppressor (Lightning Arrestor) with coaxial seal tape. Connectors: R-SMA female input and R-SMA male output.
CANRSM120TRSMF	323843-A (N0152955)	10' plenum-rated R-SMA (M) to R-SMA (F) INDOOR LMR-195, RoHS compliant cable. Cannot order separately. Included in DR4011019E5.
CANRSM120WRSMF	DR4018006E5	10' outdoor R-SMA (F) to R-SMA (M) (OUTDOOR LMR-240, RoHS compliant cable)
CANRSM300WRSMF	DR4018007E5	25' outdoor R-SMA (F) to R-SMA (M) (OUTDOOR LMR-240, RoHS compliant cable)
Bundled by SLR-COLA	DR4011019E5	Outdoor Starter bundle. Includes one 10' plenum-rated extension cable (323843-A (N0152955)), coaxial seal tape kit and surge suppressor (LAC6NRSMMF)

Surge Suppression

When installing the antenna in an outdoor configuration, the surge suppressor, DR4000085E5, is required to be inserted into the connection at or near the demarkation point from the building. Please refer to the following illustration for proper connection to the cables and proper grounding of the surge suppressor component.

Figure 22. Cable connection and grounding



Warning! A properly rated surge suppressor is required for any cable/antenna combination exiting the building. The required components must be rated and approved for use in the intended application.

Table 13: Outdoor External Antenna Selection Guide

Cushcraft	Avaya Model Number	WSS Model String	WLAN Series 2332 Access Points 2.4 GHz Antennas
S2403BPXN36RSM	DR4000088E6		WLAN Collinear Omni-directional Dipole Antenna that contains two collocated elements with an average gain of 4.9 dBi and a 3-foot cable with a Reverse SMA connector. For use in Warehouses, Auditoriums, Shopping Malls, industrial complexes and more. It can be mounted either on a pole or hung from a ceiling.
		24993-NEMA	To be used with the outdoor NEMA enclosure only. Output power is compensated for the addition of the 10-foot plenum rated cable and the lightning protection circuitry.
		24493-NEMA-10	To be used with the outdoor NEMA enclosure only. Output power is compensated for the addition of the 10-foot plenum rated cable, the lightning protection circuitry and the 10-foot outdoor rated extension cable.
		24493-NEMA-25	To be used with the outdoor NEMA enclosure only. Output power is compensated for the addition of the 10-foot plenum rated cable, the lightning protection circuitry and the 25-foot outdoor rated extension cable.
		24993-OUT	Output power is compensated for the addition of lightning protection circuitry and the 10-foot plenum rated cable.
		24993-OUT-10	The "10" refers to the addition of the 10-foot outdoor-rated LMR-240 extension cable. Output power is compensated for the addition of the 10-foot plenum rated cable, the lightning protection circuitry and the 10-foot outdoor rated extension cable.
		24993-OUT-25	The "25" refers to the addition of the 25-foot outdoor-rated LMR-240 extension cable. Output power is compensated for the addition of the 10-foot plenum rated cable, the lightning protection circuitry and the 25-foot outdoor rated extension cable.
S2409PN36RSM	DR4000076E6		WLAN Directional Patch Panel Array Antenna with an average gain of 8.8 dBi and a 3-foot cable with a Reverse SMA connector. For use where a shaped pattern is needed to provide enhanced coverage of deep rooms, warehouse bays, or any elongated activity zone.

Cushcraft	Avaya Model Number	WSS Model String	WLAN Series 2332 Access Points 2.4 GHz Antennas
		24883-NEMA	To be used with the outdoor NEMA enclosure only. Output power is compensated for the addition of the 10-foot plenum rated cable and the lightning protection circuitry.
		24883-NEMA-10	To be used with the outdoor NEMA enclosure only. Output power is compensated for the addition of the 10-foot plenum rated cable, the lightning protection circuitry and the 10-foot outdoor rated extension cable.
		24883-NEMA-25	To be used with the outdoor NEMA enclosure only. Output power is compensated for the addition of the 10-foot plenum rated cable, the lightning protection circuitry and the 25-foot outdoor rated extension cable.
		24883-OUT	Output power is compensated for the addition of lightning protection circuitry and the 10-foot plenum rated cable.
		24883-OUT-10	The "10" refers to the addition of the 10-foot outdoor-rated LMR-240 extension cable. Output power is compensated for the addition of the 10-foot plenum rated cable, the lightning protection circuitry and the 10-foot outdoor rated extension cable.
		24883-OUT-25	The "25" refers to the addition of the 25-foot outdoor-rated LMR-240 extension cable. Output power is compensated for the addition of the 10-foot plenum rated cable, the lightning protection circuitry and the 25-foot outdoor rated extension cable.
PC2415NA36RSM	DR4000077E6		WLAN 15-Element Yagi Antenna with an average gain of 14.1 dBi, 3-foot cable with a Reverse SMA connector and an articulating mount. Antenna is rugged, easy to install and provides a very symmetrical and uniform pattern. Designed for long, narrow coverage environments, like a tunnel.
		24143-NEMA	To be used with the outdoor NEMA enclosure only. Output power is compensated for the addition of the 10-foot plenum rated cable and the lightning protection circuitry.
		24143-NEMA-10	To be used with the outdoor NEMA enclosure only. Output power is compensated for the addition of the 10-foot plenum rated cable, the lightning protection circuitry and the 10-foot outdoor rated extension cable.
		24143-NEMA-25	To be used with the outdoor NEMA enclosure only. Output power is compensated for the addition of the 10-foot plenum rated cable, the lightning protection circuitry and the 25-foot outdoor rated extension cable.
		24143-OUT	Output power is compensated for the addition of lightning protection circuitry and the 10-foot plenum rated cable.

Cushcraft	Avaya Model Number	WSS Model String	WLAN Series 2332 Access Points 2.4 GHz Antennas
		24143-OUT-10	The "10" refers to the addition of the 10-foot outdoor-rated LMR-240 extension cable. Output power is compensated for the addition of the 10-foot plenum rated cable, the lightning protection circuitry and the 10-foot outdoor rated extension cable.
		24143-OUT-25	The "25" refers to the addition of the 25-foot outdoor-rated LMR-240 extension cable. Output power is compensated for the addition of the 10-foot plenum rated cable, the lightning protection circuitry and the 25-foot outdoor rated extension cable.
S241290PN36RSM	DR4000086E6		WLAN Directional Patch Panel Array Antenna with an average gain of 12 dBi, 3-foot cable with a Reverse SMA connector and either a tilt, wall or pole mounting capability. Antenna is rugged, easy to install and provides a very symmetrical and uniform 90 degree H-plane and 17 degree E-plane pattern. Designed for long, wide coverage environments.
		24123-NEMA	To be used with the outdoor NEMA enclosure only. Output power is compensated for the addition of the 10-foot plenum rated cable and the lightning protection circuitry.
		24123-NEMA-10	To be used with the outdoor NEMA enclosure only. Output power is compensated for the addition of the 10-foot plenum rated cable, the lightning protection circuitry and the 10-foot outdoor rated extension cable.
		24123-NEMA-25	To be used with the outdoor NEMA enclosure only. Output power is compensated for the addition of the 10-foot plenum rated cable, the lightning protection circuitry and the 25-foot outdoor rated extension cable.
		24123-OUT	Output power is compensated for the addition of lightning protection circuitry and the 10-foot plenum rated cable.
		24123-OUT-10	The "10" refers to the addition of the 10-foot outdoor-rated LMR-240 extension cable. Output power is compensated for the addition of the 10-foot plenum rated cable, the lightning protection circuitry and the 10-foot outdoor rated extension cable.
		24123-OUT-25	The "25" refers to the addition of the 25-foot outdoor-rated LMR-240 extension cable. Output power is compensated for the addition of the 10-foot plenum rated cable, the lightning protection circuitry and the 25-foot outdoor rated extension cable.

Cushcraft	Avaya Model Number	WSS Model String	WLAN Series 2332 Access Points 2.4 GHz Antennas
SR24120DN36RSM	DR4000087E6		WLAN Directional Patch Panel Array Antenna with an average gain of 11 dBi, 3-foot cable with a Reverse SMA connector and either a tilt, wall or pole mounting capability. Antenna is rugged, easy to install and provides a very symmetrical and uniform 120 degree H-plane and 14 degree E-plane pattern. Designed for long, wide coverage environments.
		24113-NEMA	To be used with the outdoor NEMA enclosure only. Output power is compensated for the addition of the 10-foot plenum rated cable and the lightning protection circuitry.
		24113-NEMA-10	To be used with the outdoor NEMA enclosure only. Output power is compensated for the addition of the 10-foot plenum rated cable, the lightning protection circuitry and the 10-foot outdoor rated extension cable.
		24113-NEMA-25	To be used with the outdoor NEMA enclosure only. Output power is compensated for the addition of the 10-foot plenum rated cable, the lightning protection circuitry and the 25-foot outdoor rated extension cable.
		24113-OUT	Output power is compensated for the addition of lightning protection circuitry and the 10-foot plenum rated cable.
		24113-OUT-10	The "10" refers to the addition of the 10-foot outdoor-rated LMR-240 extension cable. Output power is compensated for the addition of the 10-foot plenum rated cable, the lightning protection circuitry and the 10-foot outdoor rated extension cable.
		24113-OUT-25	The "25" refers to the addition of the 25-foot outdoor-rated LMR-240 extension cable. Output power is compensated for the addition of the 10-foot plenum rated cable, the lightning protection circuitry and the 25-foot outdoor rated extension cable.
Cushcraft	**Model Number**	**WSS Model String**	**WLAN Series 2332 Access Points 5.0 GHz Antennas**
S5153WBPN36RSM	DR4000070E6		WLAN Collinear Omni-directional Dipole Antenna that contains two collocated elements. It has an average gain of 4.5 dBi from 5.15 - 5.25 GHz, 3.8 dBi from 5.25 - 5.35 GHz, 4.7 dBi from 5.47 -5.725 GHz and 4.4 dBi from 5.725 - 5.85 GHz. It is 7" in height, and has a 3-foot cable with a Reverse SMA connector. For use in Warehouses, Auditoriums, Shopping Malls, industrial complexes and other locations.
		5643-NEMA	To be used with the outdoor NEMA enclosure only. Output power is compensated for the addition of the 10-foot plenum rated cable and the lightning protection circuitry.

Cushcraft	Model Number	WSS Model String	WLAN Series 2332 Access Points 5.0 GHz Antennas
		5643-NEMA-10	To be used with the outdoor NEMA enclosure only. Output power is compensated for the addition of the 10-foot plenum rated cable, the lightning protection circuitry and the 10-foot outdoor rated extension cable.
		5643-NEMA-25	To be used with the outdoor NEMA enclosure only. Output power is compensated for the addition of the 10-foot plenum rated cable, the lightning protection circuitry and the 25-foot outdoor rated extension cable.
		5643-OUT	Output power is compensated for the addition of lightning protection circuitry and the 10-foot plenum rated cable.
		5643-OUT-10	The "10" refers to the addition of the 10-foot outdoor-rated LMR-240 extension cable. Output power is compensated for the addition of the 10-foot plenum rated cable, the lightning protection circuitry and the 10-foot outdoor rated extension cable.
		5643-OUT-25	The "25" refers to the addition of the 25-foot outdoor-rated LMR-240 extension cable. Output power is compensated for the addition of the 10-foot plenum rated cable, the lightning protection circuitry and the 25-foot outdoor rated extension cable.
S51514WPN36RSM	DR4000071E6		WLAN Directional Patch Panel Antenna with an average gain of 13.1 dBi from 5.15 - 5.25 GHz, 13.0 dBi from 5.25 - 5.35 GHz, 13.0 dBi from 5.470 - 5.725 GHz and 12.9 dBi from 5.725 - 5.85 GHz. It has a 3-foot cable with a Reverse SMA connector. For use in campus or in-building applications. It offers a very precise and controllable pattern. Must order mounting bracket separately.
		5133-NEMA	To be used with the outdoor NEMA enclosure only. Output power is compensated for the addition of the 10-foot plenum rated cable and the lightning protection circuitry.
		5133-NEMA-10	To be used with the outdoor NEMA enclosure only. Output power is compensated for the addition of the 10-foot plenum rated cable, the lightning protection circuitry and the 10-foot outdoor rated extension cable.
		5133-NEMA-25	To be used with the outdoor NEMA enclosure only. Output power is compensated for the addition of the 10-foot plenum rated cable, the lightning protection circuitry and the 25-foot outdoor rated extension cable.
		5133-OUT	Output power is compensated for the addition of lightning protection circuitry and the 10-foot plenum rated cable.

Cushcraft	Model Number	WSS Model String	WLAN Series 2332 Access Points 5.0 GHz Antennas
		5133-OUT-10	The "10" refers to the addition of the 10-foot outdoor-rated LMR-240 extension cable. Output power is compensated for the addition of the 10-foot plenum rated cable, the lightning protection circuitry and the 10-foot outdoor rated extension cable.
		5133-OUT-25	The "25" refers to the addition of the 25-foot outdoor-rated LMR-240 extension cable. Output power is compensated for the addition of the 10-foot plenum rated cable, the lightning protection circuitry and the 25-foot outdoor rated extension cable.
S4901790PN36RS	DR4000090E6		WLAN Directional Patch Panel Antenna with an average gain of 15.7 dBi from 5.15 - 5.25 GHz, 15.9 dBi from 5.25 - 5.35 GHz, 16.0 dBi from 5.470 - 5.725 GHz and 15.8 dBi from 5.725 - 5.85 GHz. It has a 3-foot cable with a Reverse SMA connector and either a tilt, wall or pole mounting capability. Antenna is rugged, easy to install and provides a very symmetrical and uniform 90 degree H-plane and 5.5 degree E-plane pattern. Designed for long, wide coverage environments.
		5173-NEMA	To be used with the outdoor NEMA enclosure only. Output power is compensated for the addition of the 10-foot plenum rated cable and the lightning protection circuitry.
		5173-NEMA-10	To be used with the outdoor NEMA enclosure only. Output power is compensated for the addition of the 10-foot plenum rated cable, the lightning protection circuitry and the 10-foot outdoor rated extension cable.
		5173-NEMA-25	To be used with the outdoor NEMA enclosure only. Output power is compensated for the addition of the 10-foot plenum rated cable, the lightning protection circuitry and the 25-foot outdoor rated extension cable.
		5173-OUT	Output power is compensated for the addition of lightning protection circuitry and the 10-foot plenum rated cable.
		5173-OUT-10	The "10" refers to the addition of the 10-foot outdoor-rated LMR-240 extension cable. Output power is compensated for the addition of the 10-foot plenum rated cable, the lightning protection circuitry and the 10-foot outdoor rated extension cable.
		5173-OUT-25	The "25" refers to the addition of the 25-foot outdoor-rated LMR-240 extension cable. Output power is compensated for the addition of the 10-foot plenum rated cable, the lightning protection circuitry and the 25-foot outdoor rated extension cable.

SR49120DAN36RS DR4000091E6		WLAN Directional Patch Panel Antenna with an average gain of 10.0 dBi from 5.15 - 5.25 GHz, 9.9 dBi from 5.25 - 5.35 GHz, 9.6 dBi from 5.470 - 5.725 GHz and 9.5 dBi from 5.725 - 5.85 GHz. It has a 3-foot cable with a Reverse SMA connector and either a wall or pole mounting capability. Antenna is rugged, easy to install and provides a very symmetrical and uniform 120 degree H-plane and 15 degree E-plane pattern. Designed for long, wide coverage environments.
	5103-NEMA	To be used with the outdoor NEMA enclosure only. Output power is compensated for the addition of the 10-foot plenum rated cable and the lightning protection circuitry.
	5103-NEMA-10	To be used with the outdoor NEMA enclosure only. Output power is compensated for the addition of the 10-foot plenum rated cable, the lightning protection circuitry and the 10-foot outdoor rated extension cable.
	5103-NEMA-25	To be used with the outdoor NEMA enclosure only. Output power is compensated for the addition of the 10-foot plenum rated cable, the lightning protection circuitry and the 25-foot outdoor rated extension cable.
	5103-OUT	Output power is compensated for the addition of lightning protection circuitry and the 10-foot plenum rated cable.
	5103-OUT-10	The "10" refers to the addition of the 10-foot outdoor-rated LMR-240 extension cable. Output power is compensated for the addition of the 10-foot plenum rated cable, the lightning protection circuitry and the 10-foot outdoor rated extension cable.
	5103-OUT-25	The "25" refers to the addition of the 25-foot outdoor-rated LMR-240 extension cable. Output power is compensated for the addition of the 10-foot plenum rated cable, the lightning protection circuitry and the 25-foot outdoor rated extension cable.

Antenna properties and considerations

In the design and installation of a WLAN system, system installers need to have some fundamental knowledge of antenna performance and RF propagation characteristics to ensure efficient performance of the network. This knowledge will assist these individuals with the proper selection of system antennas, as well as, guiding their decisions on antenna mounting location and orientation in an effort to ensure optimum system coverage and performance. A properly selected antenna system has the capability of improving overall system performance and may lead to a reduction in system cost if the overall number of access points can be reduced. Conversely, a poorly selected antenna system may degrade system performance and may lead to an increase in overall system cost.

Antenna properties

The external antennas supported by the WLAN 2332 system are passive devices. A key attribute included in their design is that they are DC-coupled to the output of the WLAN access point to enable the software to detect their presence and direct the energy out their aperture rather than through the internal antennas mounted within the access point housing. Since they are passive devices, they do not process nor amplify the RF signal. Even if they are 100% efficient, they cannot radiate more total power than is delivered to their input terminal from the access point.

The basic properties that are used to describe the performance of an antenna include impedance and VSWR (Voltage Standing Wave Ratio), radiation patterns, 3-dB beamwidth, directivity, gain, EIRP (Effective Isotropic Radiated Power), polarization and bandwidth. These properties and their impact on system performance are discussed in the following sections.

Impedance and VSWR

In order to achieve maximum power transfer between an access point and an antenna, the input impedance of the antenna must identically match the characteristic impedance of the output of the access point. If the two impedances do not match, a reflected wave will be created at the antenna input and travel back towards the access point. This reflection is associated with a mismatch loss between the access point and the antenna and results in an overall reduction of system efficiency and available transmission power. The WLAN supported external antennas have been designed to match the output impedance of the WLAN Series 2332 access points to ensure optimum system power transfer.

The Voltage Standing Wave Ratio or VSWR is the ratio between the maximum voltage and the minimum voltage that appears along the transmission line connecting the access point to the antenna. The VSWR, which can be derived from the level of reflected and forward waves, is also an indication of how closely or efficiently an antenna's input impedance is matched to the characteristic impedance of the cabling and output impedance of the access point. An increase in VSWR indicates an increase in the mismatch between the antenna and the access point. These increases can be a direct result of corrosion, damaged cables, loose connections or seals and lengthy cable extensions from the access point. All of these concerns must be checked and optimized during the installation of the antenna system by the professional installer.

To indicate how increased VSWR impacts overall system performance, the table below details the percentage of power reflected by the antenna, and the resultant overall transmission loss, for several typical VSWR values. For a 1.5:1 VSWR, the transmission loss is approximately 0.2 dB or a 4.0% reduction in efficiency.

Table 14: VSWR, % Reflected Power and Transmission Loss

VSWR	% Reflected Power	Transmission Loss [dB]
1.0 : 1	0.00	0.00
1.1 : 1	0.23	0.01
1.2 : 1	0.83	0.04
1.5 : 1	4.00	0.18
2.0 : 1	11.11	0.51
2.5 : 1	18.37	0.88
3.0 : 1	25.00	1.25

Radiation Patterns and 3-dB Beamwidth

The radiation patterns of an antenna describe how the antenna directs the energy it radiates. As stated earlier, an antenna cannot radiate more total energy than is delivered to its input. All antennas, if 100% efficient, will radiate the same total energy for equal input power, regardless of the shape of the radiating pattern.

In many cases, the convention of an E-plane and H-plane pattern is used in the presentation of antenna pattern data. The E-plane is the plane that contains the antenna's radiated electric field potential while the H-plane is the plane that contains the antenna's radiated magnetic field potential. These planes are always orthogonal. For dipole and Yagi antennas, the E-plane is always in the plane parallel to the linear antenna elements.

The information obtained from these plots includes the 3-dB beamwidth. The 3-dB beamwidth of an antenna is a measure of the angular width or spread of the signal at the points on the radiating signal where the power has been reduced to 1/2 of its original power level.

Additional factors that affect the antenna's efficiency are the antenna side lobe level and front to back ratio. These parameters are measures of how much energy the antenna radiates outside of its main beam. The side lobe level describes the relative level of minor pattern lobes outside the main beam while the front to back ratio describes the level of radiation directly opposite (180 degrees away) from the main beam. Ideally, these levels should be as low as possible since they reduce the directivity and efficiency of the main beam. When transmitting, the presence of side and back lobes may cause interference to other nearby access points, and when receiving, they may allow interference into the access point from surrounding WLANs or rogue devices.

Directivity and Gain

The directivity of an antenna is a relative measure of how an antenna focuses or directs the energy it radiates in the main beam of the antenna pattern. It is defined as the ratio of the antenna radiation intensity in a specific direction to the radiation intensity of an isotropic radiator for the same radiated power. The higher the directivity, the more focused the antenna pattern.

The gain of an antenna is closely related to its directivity, but takes into consideration the losses in the antenna, such as conduction and dielectric losses, as well as, the directional capabilities of the antenna. By definition, it is equal to 4 times the ratio of the maximum radiation intensity to the net power accepted by the antenna at its input.

Gain is measured on a far-field outdoor test range by comparing the gain of the antenna under test to that of a pre-calibrated Standard Gain antenna:

$$G = 10 \log_{10} \frac{(4 * A_e)}{(\lambda^2)}$$

Where G = antenna gain in dB

λ= operating wavelength in meters

A_e = effective aperture in square meters

If we double the length of the aperture, the gain of the antenna is doubled, which means the gain increases by 3 dB.

An antenna's efficiency is a measure of the ratio of the gain of an antenna to its directivity. If an antenna were 100% efficient, it would have a gain equal to its directivity. The VSWR provides an indication of how closely the impedance of an antenna matches the impedance of the connecting access point. If an impedance mismatch exists, a reflected wave will be created and will reduce the level of forward energy transferred from the access point into the antenna. This effectively reduces the total level of radiated energy and the effective gain of the antenna.

Effective Radiated Power

Effective Isotropic Radiated Power (EIRP) is a figure of merit for the net radiated power in a given direction. It is equal to the product of the power supplied to an antenna and the antenna gain in a given direction relative to an isotropic radiator. It can be expressed in watts or dBm.

Polarization

The polarization of an antenna describes the orientation and sense of the radiated wave's electric field vector. All radiated waves are defined as elliptically polarized. In this general case, the antenna's total electric field (E-field) has two components that lie in the same plane. These two E-field components may be of different strength and are oriented at different angles.

The most common cases of elliptical polarization are:

Circular, in which the two E-field components are equal in magnitude, 90 degrees out of phase and spatially oriented at 90 degrees from one another, and

Linear, in which the wave has a single E-field component. In a linear polarized antenna, the E-field is either in a vertical line, a horizontal line or a slanted line, such as 45 degrees from the horizontal.

The term axial ratio is used to define the relative strength of the two E-field components in an elliptically polarized wave. For pure circular polarization the axial ratio is 0 dB and for linear polarization the axial ratio is infinite.

The important performance issue relative to signal polarization is that maximum energy transfer between a transmitting antenna and a receiving antenna will only occur if both antennas have identical axial ratio, identical polarization sense and the same spatial orientation. It is assumed that nothing in the propagation path causes the signal polarization to change, which is known as polarization distortion.

With linearly polarized antennas, the polarization of each antenna must be of the same orientation to achieve maximum energy transfer between the two antennas. If the two linearly polarized antennas are not identically oriented, there will be a reduction in energy transfer due to polarization mismatch. The table below provides a summary of polarization mismatch loss between two linearly polarized antennas that do not have the same angular orientation.

Table 15: Polarization mismatch

Orientation angle	Polarization mismatch (dB)
0.0 (aligned)	0.00
15.0	0.30
30.0	1.25
45.0	3.01
60.0	6.02
75.0	11.74
90.0 (orthogonal)	infinite

The following table provides a summary of the polarization mismatch between a linearly polarized and a circularly polarized wave as a function of the circularly polarized wave's axial ratio. It is assumed that the circularly polarized wave's field components are orthogonal.

Table 16: Polarization mismatch between linear and circular polarized waves

Axial Ratio	Minimum Polarization Loss [dB]	Maximum Polarization Loss [dB]
0.00	3.01	3.01
0.25	2.89	3.14
0.50	2.77	3.27
0.75	2.65	3.40
1.00	2.54	6.54
1.50	2.33	3.83
2.00	2.12	4.12
3.00	1.77	4.77
4.00	1.46	5.46
5.00	1.19	6.19
10.00	0.41	10.41

Bandwidth

The term bandwidth simply defines the frequency range over which an antenna meets a certain set of performance criteria. The important issue to consider regarding bandwidth is the performance tradeoffs between all of the properties described above as the bandwidth is widened to cover more area.

Summary of Related Performance Tradeoff Issues

The antenna properties described above are all related in varying degrees. In selecting or designing an antenna system, the tradeoffs between all of these performance properties must be considered in order to ensure optimum system performance. These factors must also be weighed against factors beyond the actual antenna properties such as RF propagation and path loss.

In all cases, the required or specified performance properties of an antenna can only be achieved over a limited frequency bandwidth. The extent of this realizable bandwidth is a function of the performance requirements, antenna type selected and the antenna size relative to the operating wavelength. Typically, optimum antenna performance is achieved at the center frequency of the operating band.

In the case of VSWR, system performance is typically degraded at the edges of the operating frequency band. The overall effect on system performance is a decrease in antenna gain due to impedance mismatch losses. The antenna's radiation patterns, beamwidth, directivity (gain) and bandwidth are more directly related. As with VSWR, performance is usually degraded at the edges of the operating band.

The 3-dB beamwidth and directivity (gain) are inversely proportional. As the antenna beamwidth decreases, the directivity increases. These parameters are also related to the antenna size or aperture. As the antenna aperture or size increases with respect to the operating wavelength, the radiation beamwidth decreases. Therefore, to achieve increased antenna gain, it is required that the antenna size increase.

For linearly polarized antennas, polarization is generally not a function of bandwidth. However, this is not always the case for circularly polarized antennas. In most cases, the polarization axial ratio for a circularly polarized antenna increases at the edges of the operating frequency band.

RF Propagation and Path Loss

In addition to the antenna properties and wireless system hardware, other factors can influence the overall performance of the WLAN system. These factors affect the propagation of RF signals through the air medium and need to be considered when architecting a WLAN.

Path loss is encountered when an RF signal propagates through the air. The relative signal strength of the propagating wave diminishes as a function of distance traveled from the transmitting antenna.

The free space propagation loss factor is described by the following equation,

$$\text{Path Loss [dB]} = 10 \log_{10} (4\pi r/\lambda)^n$$

Where
r is the measured path distance from the transmitting antenna
λ is the free space wavelength defined by C/F
C is the speed of light (measured in cm/sec)
F is the frequency of propagation (measured in MHz)
n is the path loss coefficient, whereby n=2 represents free space and factors of n>2 represent environments where additional signal losses are incurred due to factors like multipath. It should be noted that typical office path loss coefficients have been measured to be between 3.6 and 6.0, depending upon the material used in construction of the facilities. The table below represents the path loss for a coefficient of n=2.

Table 17: Path loss in [dB] for loss coefficient of n=2

	Frequency (MHz)								
Distance (m)	**2400**	**2450**	**2500**	**5150**	**5250**	**5350**	**5470**	**5725**	**5850**
10	-60.0	-60.2	-60.4	-66.7	-66.8	-67.0	-67.2	-67.6	-67.8
50	-74.0	-74.0	-74.4	-80.7	-80.8	-81.0	-81.2	-81.6	-81.8
100	-80.0	-80.0	-80.4	-86.7	-86.8	-87.0	-87.2	-87.6	-87.8
150	-83.6	-83.6	-83.9	-90.2	-90.4	-90.5	-90.7	-91.1	-91.3
200	-86.1	-86.1	-86.4	-92.7	-92.9	-93.0	-93.2	-93.6	-93.8
250	-88.0	-88.0	-88.4	-94.6	-94.8	-95.0	-95.2	-95.6	-95.7
300	-89.4	-89.6	-89.9	-96.2	-96.4	-96.6	-96.7	-97.1	-97.3
350	-90.9	-90.9	-91.3	-97.6	-97.7	-97.9	-98.1	-98.5	-98.7
400	-92.1	-92.1	-92.4	-98.7	-98.9	-99.1	-99.2	-99.6	-99.8
500	-94.0	-94.0	-94.4	-100.7	-100.8	-101.0	-101.2	-101.6	-101.8
750	-97.5	-97.5	-97.9	-104.2	-104.3	-104.5	-104.7	-105.1	-105.3
1000	-100.0	-100.2	-100.4	-106.7	-106.8	-107.0	-107.2	-107.6	-107.8

To minimize path loss effects, you can either increase the transmit power, increases the system gain, decrease the operating frequency or increase the receiver sensitivity on the other end of the wireless communications link. In addition, path loss increases by a factor of approximately 6 dB for every doubling of frequency or path distance. This factor is significant because it means that a doubling of the antenna or system gain, an increase of 3 dB, will not double the propagation distance of the signal. To double the usable coverage area or path distance, the antenna or system gain would have to increase by a factor of four, which equates to an increase of 6 dB.

In addition to the free space path loss mentioned above, RF signals will be attenuated as they pass through objects such as foliage, walls and buildings. The level of signal attenuation in these instances can increase the loss and reduce the communications range by an additional amount of 10 to 20 dB or greater. Care should be used when installing the antennas and access points to ensure that no objects or barriers are blocking the communication paths of the antennas.

Most, if not all, antenna performance characteristics are specified under free space conditions. It is important to realize that these performance characteristics may change once the antenna is located in its operating environment. Surrounding objects, such as the earth, walls, buildings, floors, etc. will impact the antenna's specified performance. The fact that antenna performance may change in the operating environment does not invalidate the use of free space data. It is impossible to specify performance for all environments and the free space performance characteristics provide the most suitable reference for comparing relative antenna performance.

When an antenna is located near the earth, its radiated field couples with the earth and changes the antenna's radiation pattern and impedance characteristics. The antenna impedance is changed from its free space value by the addition of a component known as ground impedance. The presence of this component changes how RF energy is delivered to the antenna in that some energy normally radiated by the antenna is now dissipated in the earth. This will reduce the system efficiency.

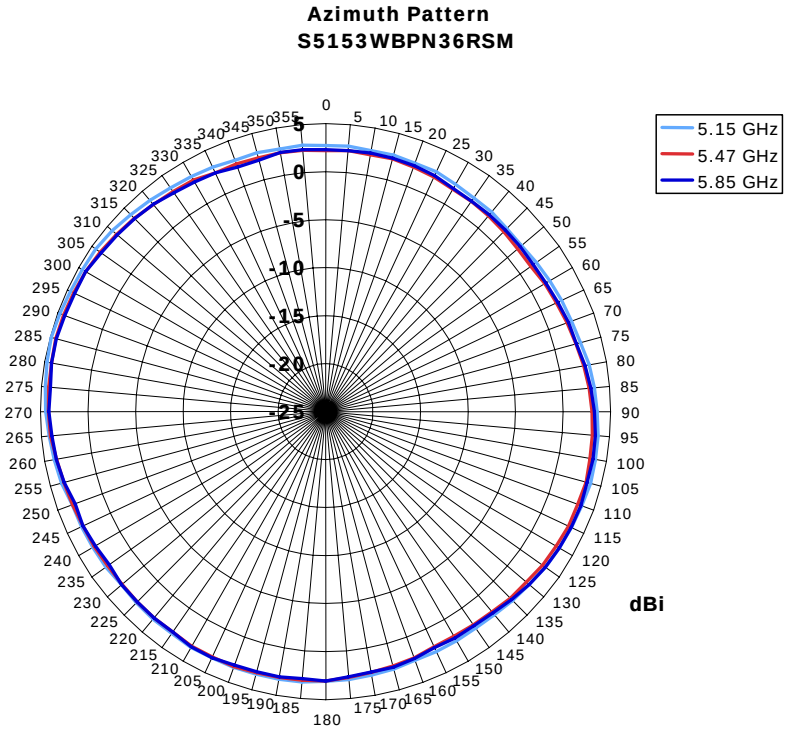
In addition to impacting the antenna impedance, the earth also changes the antenna's radiation pattern and polarization depending upon the height the antenna is located above the ground. When an antenna is located over the earth, an "image" is generated in the earth. This image will contribute to the total radiated field by vector summing the direct and reflected waves. This is essentially a multipath phenomenon and illustrates how the antenna height affects pattern performance. Mechanical down-tilt can be used to try and compensate for these effects. Down-tilt refers to tilting the main beam downward, away from the perpendicular with the horizon. Mechanical down-tilt really only applies to sectorized antennas that have narrow horizontal beamwidths of less than or equal to 60 degrees. The narrower the azimuth pattern, the more uniform the tilt will be across the 3-dB beamwidth of the antenna.

Optimizing antenna location can reduce multipath and interference problems. This includes antenna height, as well as, location relative to nearby objects. Protecting against multipath fading is difficult and may require other techniques, such as diversity, to mitigate multipath interference. Overall antenna selection and location optimization is not an arbitrary task. It does require an evaluation of system coverage and range requirements, a review of access point locations, and a review of surrounding objects that may become a source of interference.

Antenna descriptions – 802.11a (5.0 GHz) antennas

1 Order Number: DR4000070E6

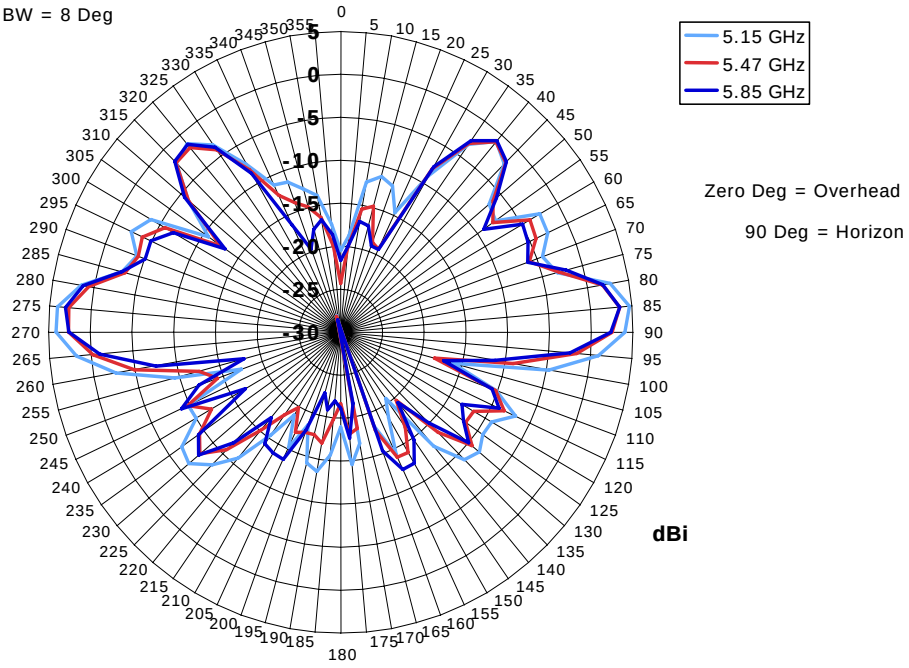
- Wide-band Omni Antenna
- Cushcraft Model S5153WBPN36RSM
- 5.15 - 5.25 GHz, 4.5 dBi Peak Gain
- 5.25 - 5.35 GHz, 3.8 dBi Peak Gain
- 5.47 - 5.725 GHz, 4.7 dBi Peak Gain
- 5.725 - 5.85 GHz, 4.4 dBi Peak Gain
- Rugged design suitable for outdoor environments
- Ceiling, I-beam and mast mounting options
- Suitable for large indoor open spaces and locations with high ceilings
- Slim aspect measuring 11.5” x 1”


Azimuth Pattern
S5153WBPN36RSM
5.15 GHz
5.47 GHz
5.85 GHz
dBi
5
0
-5
-10
-15
-20
-25

Elevation Pattern
S5153WBPN36RSM

3 dB BW = 15 Deg

1 dB BW = 8 Deg



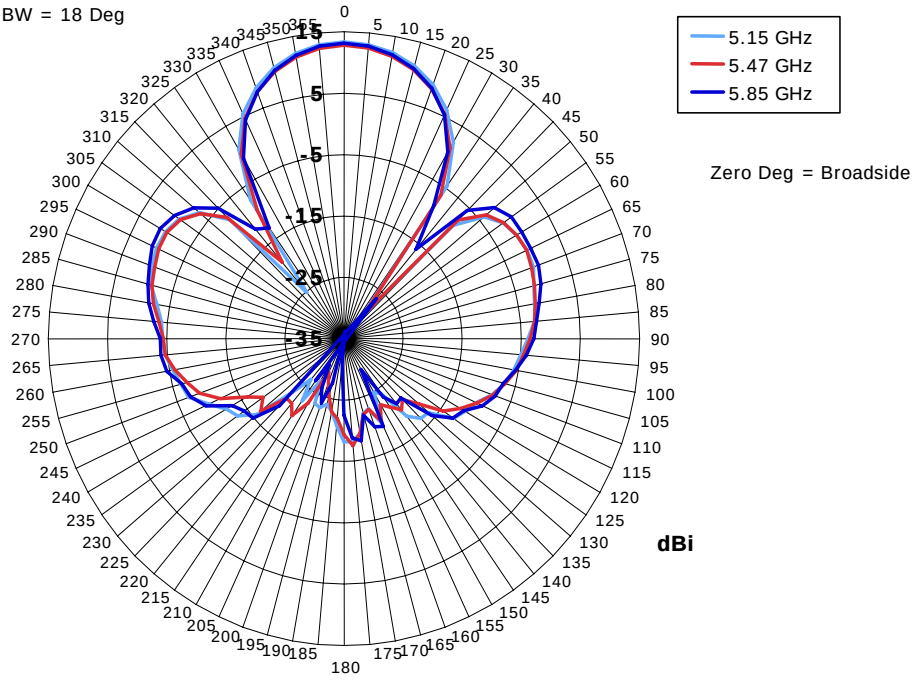
2 Order Number: DR4000071E6

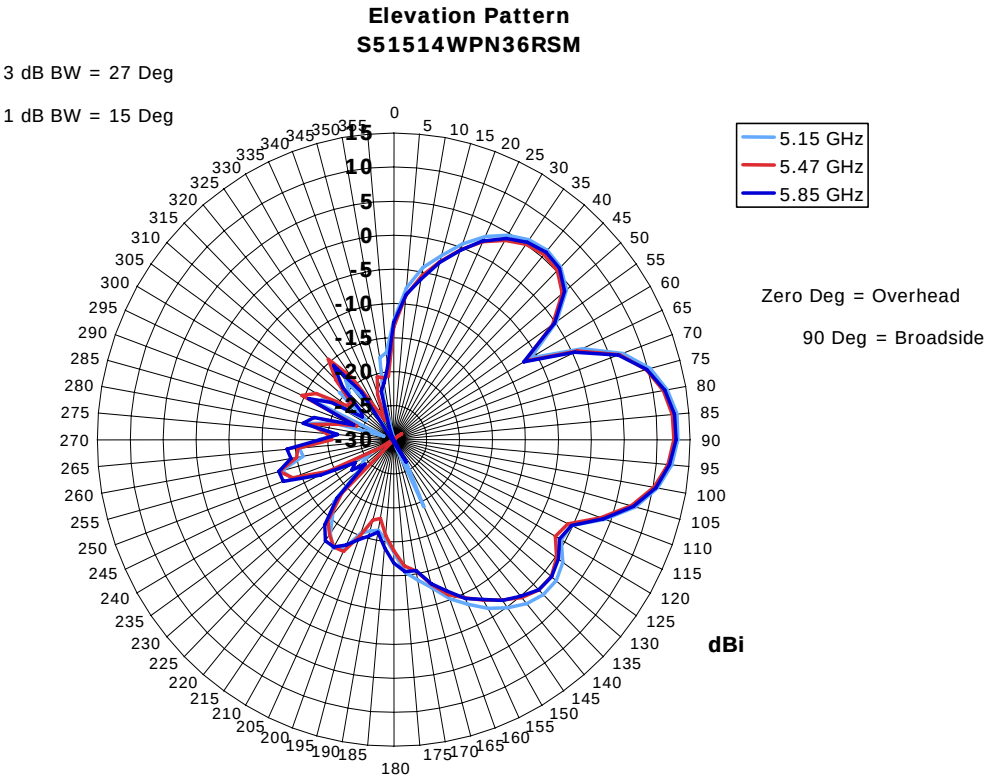
- High-Gain Directional Panel Antenna
- Cushcraft Model S51514WPN36RSM
- 5.15 - 5.25 GHz, 13.1 dBi Peak Gain
- 5.25 - 5.35 GHz, 13.0 dBi Peak Gain
- 5.47 - 5.725 GHz, 13.0 dBi Peak Gain
- 5.725 - 5.85 GHz, 12.9 dBi Peak Gain
- Weatherproof housing for indoor/outdoor deployments
- Wall or pole mounting
- Articulating feature allows customizable antenna pattern
- Measures 4” x 4” x 1.4”

Azimuth Pattern
S51514WPN36RSM

3 dB BW = 33 Deg

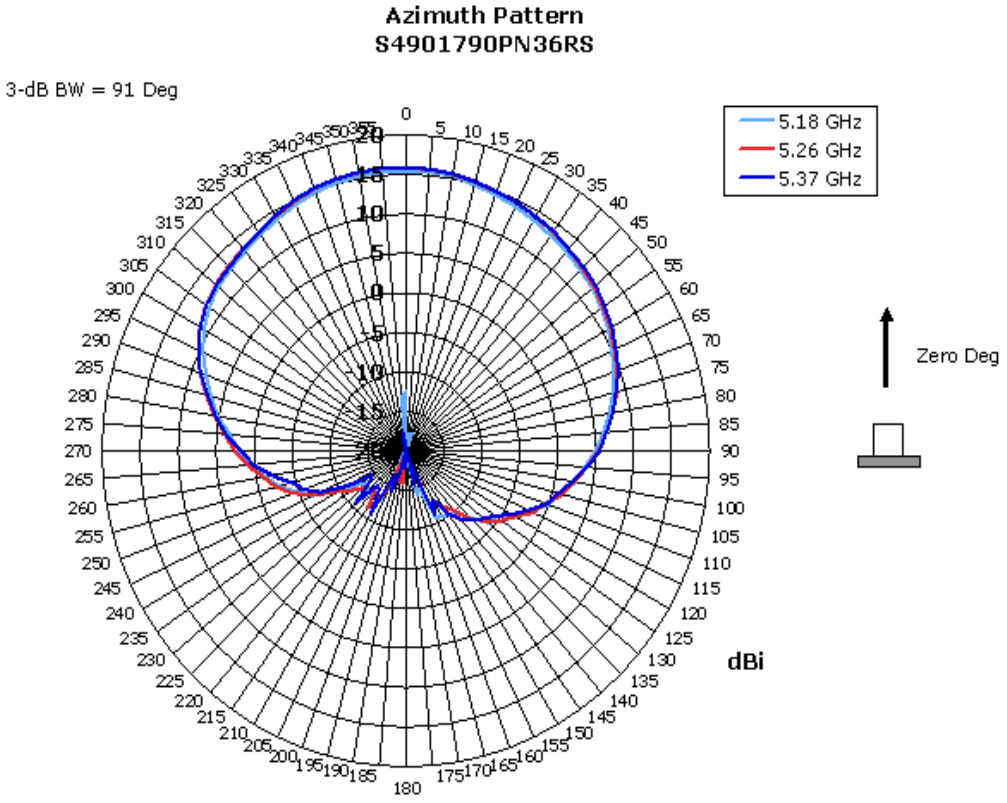
1 dB BW = 18 Deg

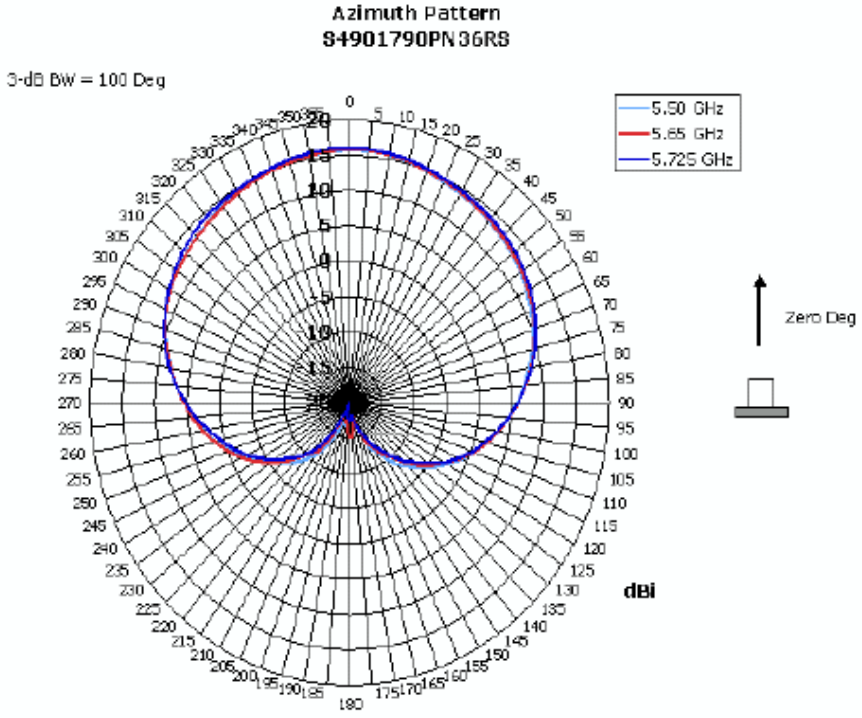


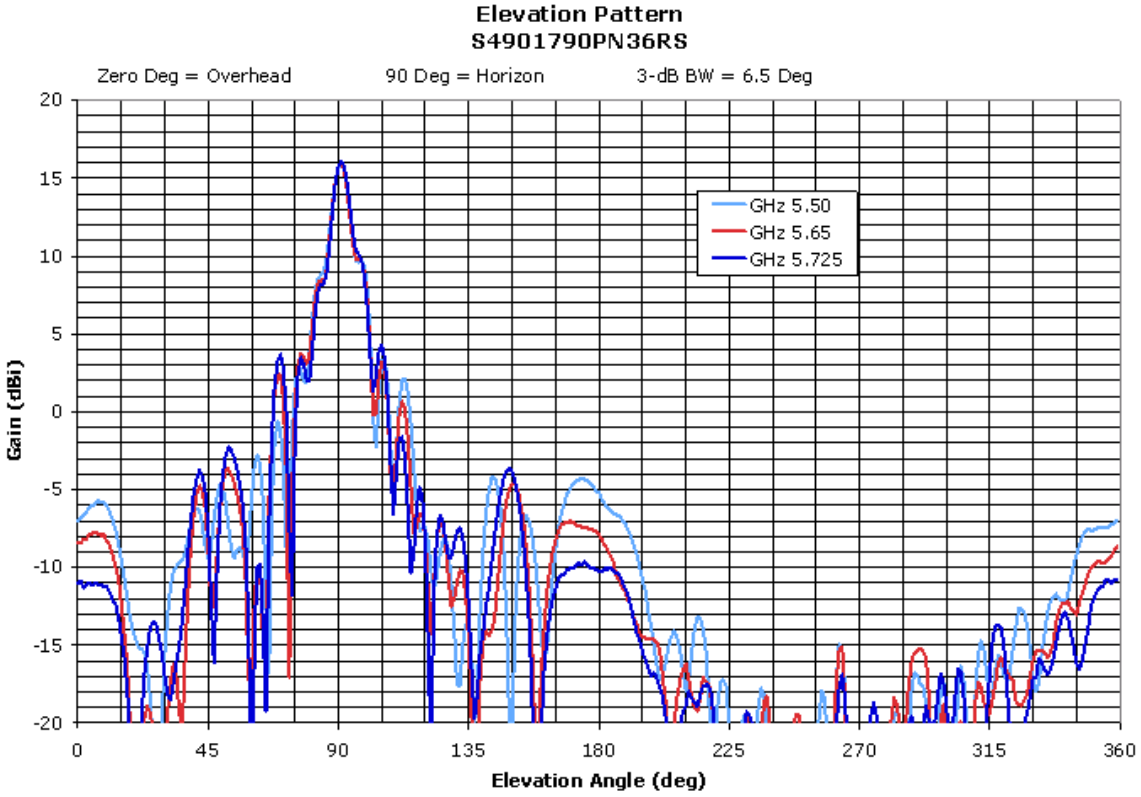

Elevation Pattern
S51514WPN36RSM
3 dB BW = 27 Deg
1 dB BW = 15 Deg
5.15 GHz
5.47 GHz
5.85 GHz
Zero Deg = Overhead
90 Deg = Broadside
dBi

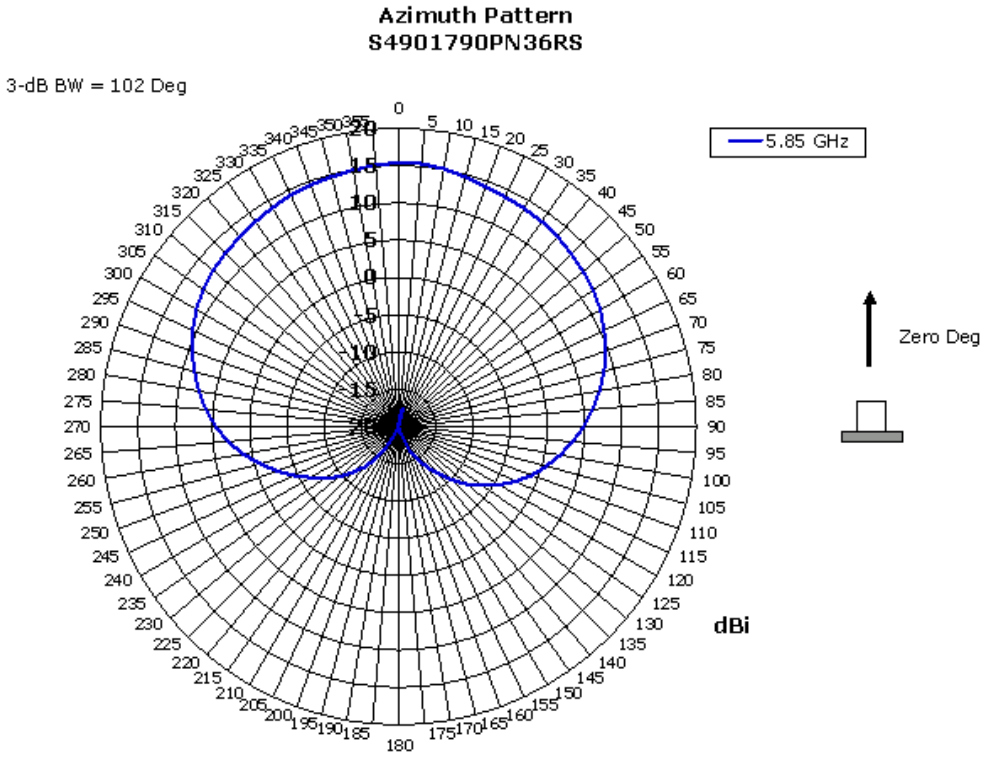
3 High-Gain Directional Panel Antenna

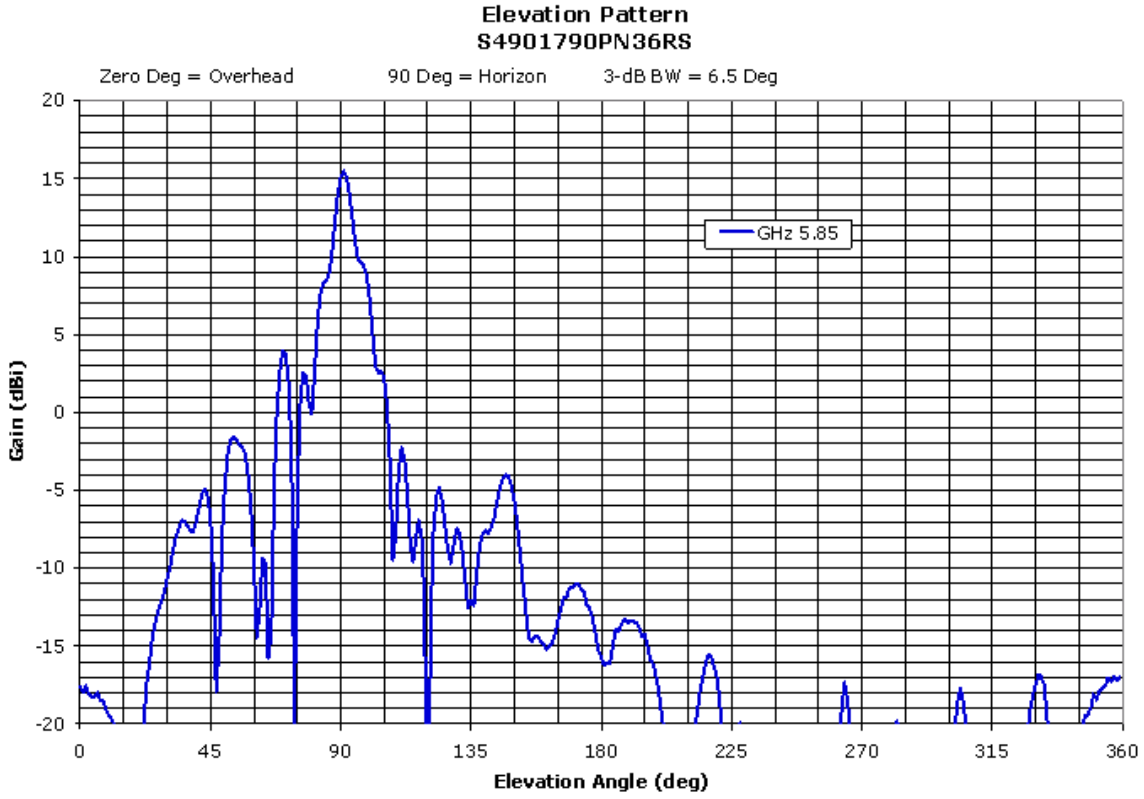
- Order Number: DR4000090E6
- Cushcraft Model S4901790PN36RS
- 5.15 - 5.25 GHz, 15.7 dBi Peak Gain
- 5.25 - 5.35 GHz, 15.9 dBi Peak Gain
- 5.470 - 5.725 GHz, 16.0 dBi Peak Gain
- 5.725 - 5.85 GHz, 15.8 dBi Peak Gain
- Wall or pole mounting available for 1.5" to 3.5" diameter pole giving up to 15° of down-tilt
- Symmetrical and uniform 90 degree H-plane and 5.5 degree E-plane patterns
- Measures 2.74" in diameter x 24.6" Long


Azimuth Pattern
S4901790PN36RS
3-dB BW = 91 Deg
5.18 GHz
5.26 GHz
5.37 GHz
Zero Deg
dBi


Azimuth Pattern
S4901790PN36RS
3-dB BW = 100 Deg
5.50 GHz
5.65 GHz
5.725 GHz
Zero Deg
dBi

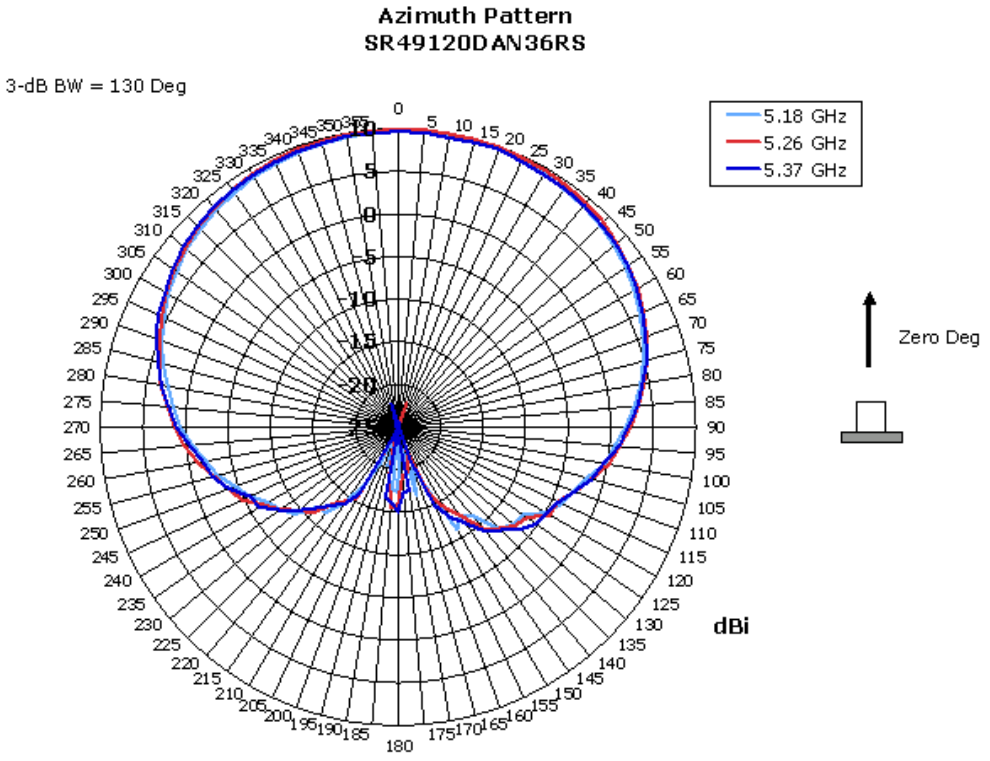

Elevation Pattern
S4901790PN36RS
Zero Deg = Overhead
90 Deg = Horizon
3-dB BW = 6.5 Deg
GHz 5.50
GHz 5.65
GHz 5.725
Gain (dBi)
20
15
10
5
0
-5
-10
-15
-20
0
45
90
135
180
225
270
315
360
Elevation Angle (deg)

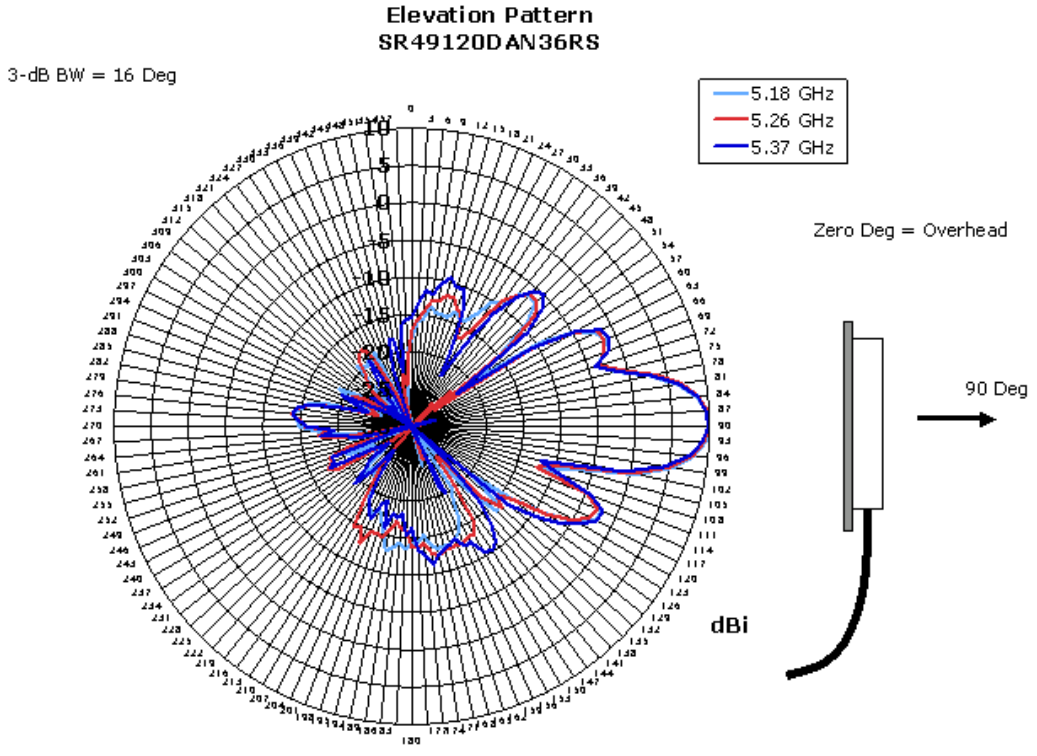

Azimuth Pattern
S4901790PN36RS
3-dB BW = 102 Deg
5.85 GHz
Zero Deg
dBi
20
15
10
5
0
-5
-10
-15
-20

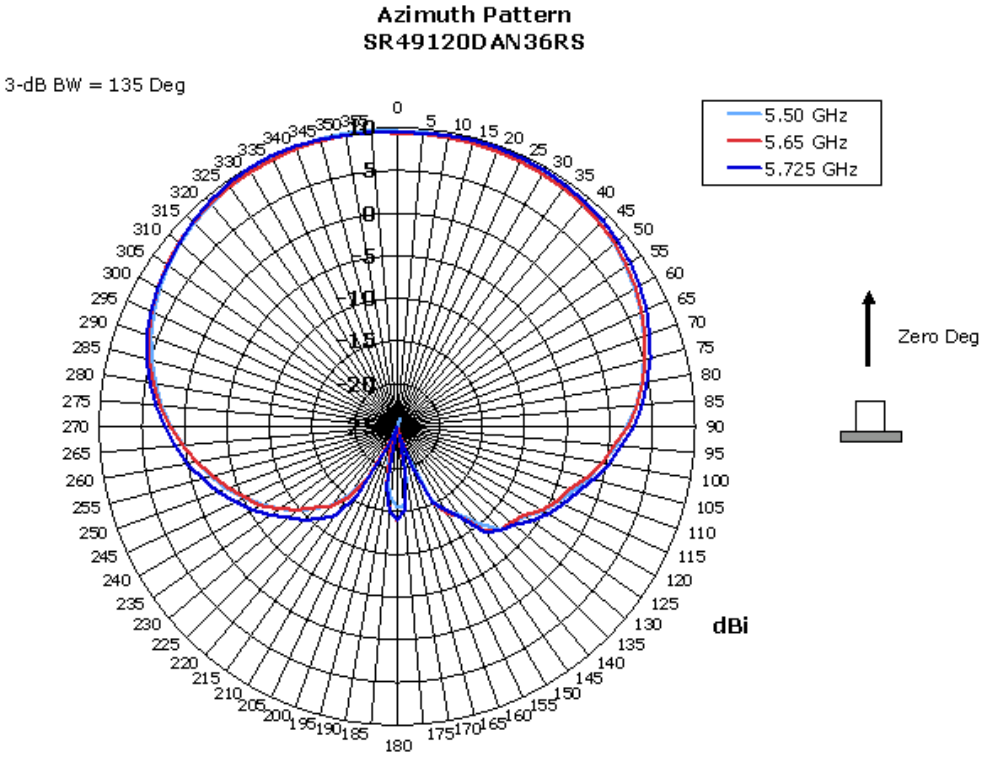

Elevation Pattern
S4901790PN36RS
Zero Deg = Overhead
90 Deg = Horizon
3-dB BW = 6.5 Deg
GHz 5.85
Gain (dBi)
20
15
10
5
0
-5
-10
-15
-20
0
45
90
135
180
225
270
315
360
Elevation Angle (deg)

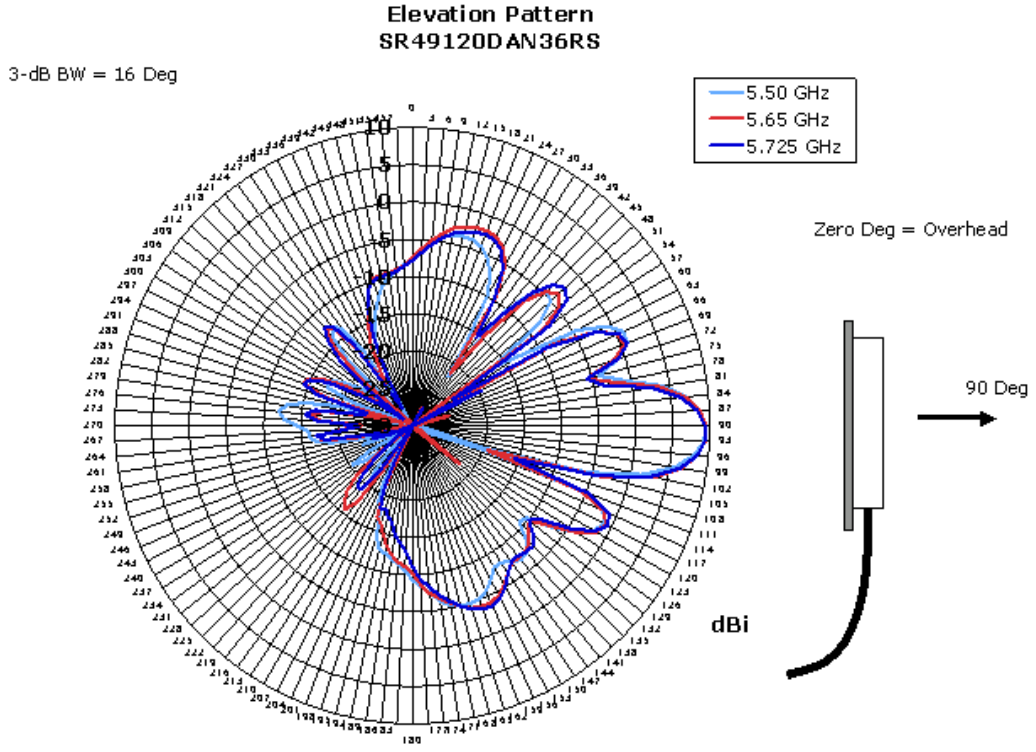
4 High-Gain Directional Panel Antenna

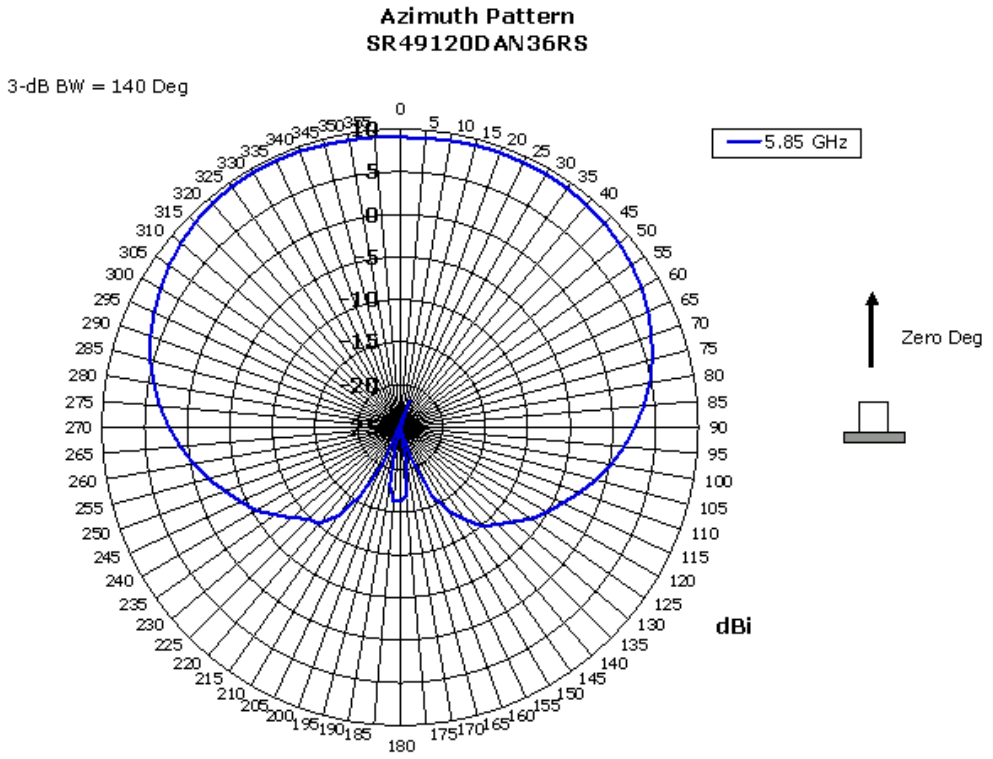
- Order Number: DR4000091E6
- Cushcraft Model SR49120DAN36RS
- 5.15 - 5.25 GHz, 10.0 dBi Peak Gain
- 5.25 - 5.35 GHz, 9.9 dBi Peak Gain
- 5.470 - 5.725 GHz, 9.6 dBi Peak Gain
- 5.725 - 5.85 GHz, 9.5 dBi Peak Gain
- Wall or pole mounting options available
- Symmetrical and uniform 120 degree H-plane and 15 degree E-plane patterns
- Measures 1" x 2.4" x 9.5"

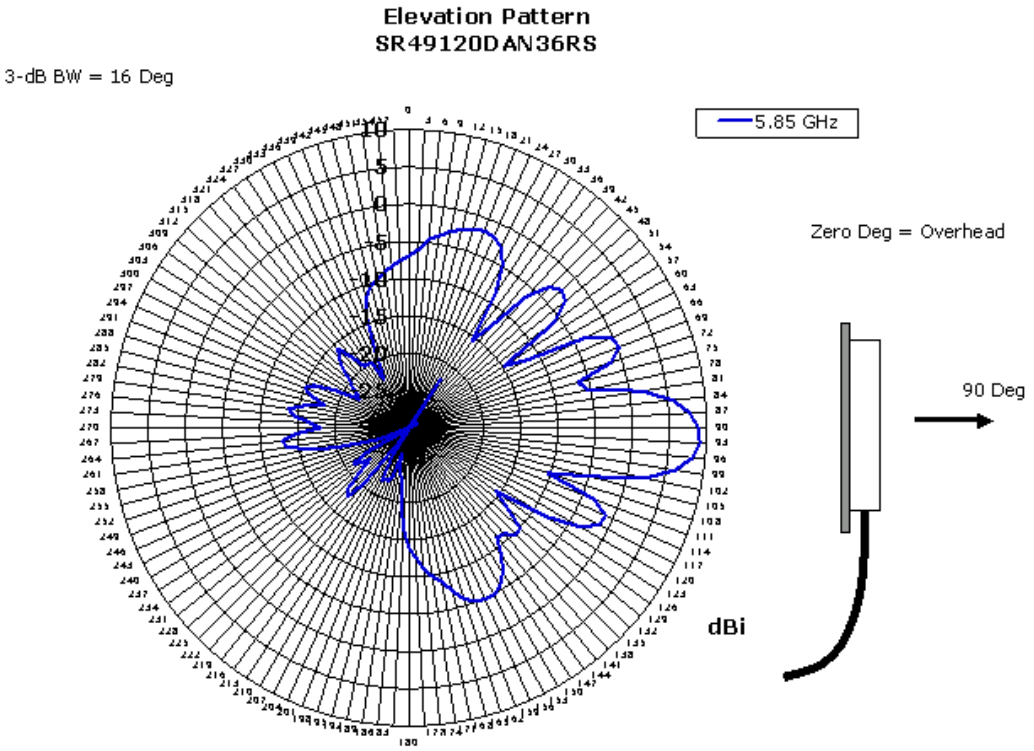

Azimuth Pattern
SR49120DAN36RS
3-dB BW = 130 Deg
5.18 GHz
5.26 GHz
5.37 GHz
Zero Deg
dBi


Elevation Pattern
SR49120DAN36RS
3-dB BW = 16 Deg
5.18 GHz
5.26 GHz
5.37 GHz
Zero Deg = Overhead
90 Deg
dBi


Azimuth Pattern
SR49120DAN36RS
3-dB BW = 135 Deg
5.50 GHz
5.65 GHz
5.725 GHz
Zero Deg
dBi


Elevation Pattern
SR49120DAN36RS
3-dB BW = 16 Deg
5.50 GHz
5.65 GHz
5.725 GHz
Zero Deg = Overhead
90 Deg
dBi


Azimuth Pattern
SR49120DAN36RS
3-dB BW = 140 Deg
5.85 GHz
Zero Deg
dBi

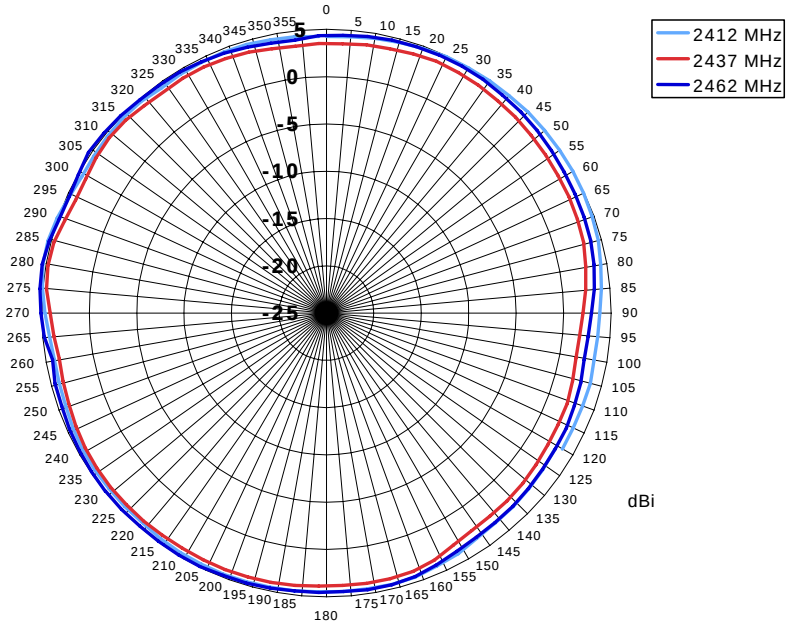

Elevation Pattern
SR49120DAN36RS
3-dB BW = 16 Deg
5.85 GHz
Zero Deg = Overhead
90 Deg
dBi

Antenna descriptions – 802.11b/g (2.4GHz) antennas

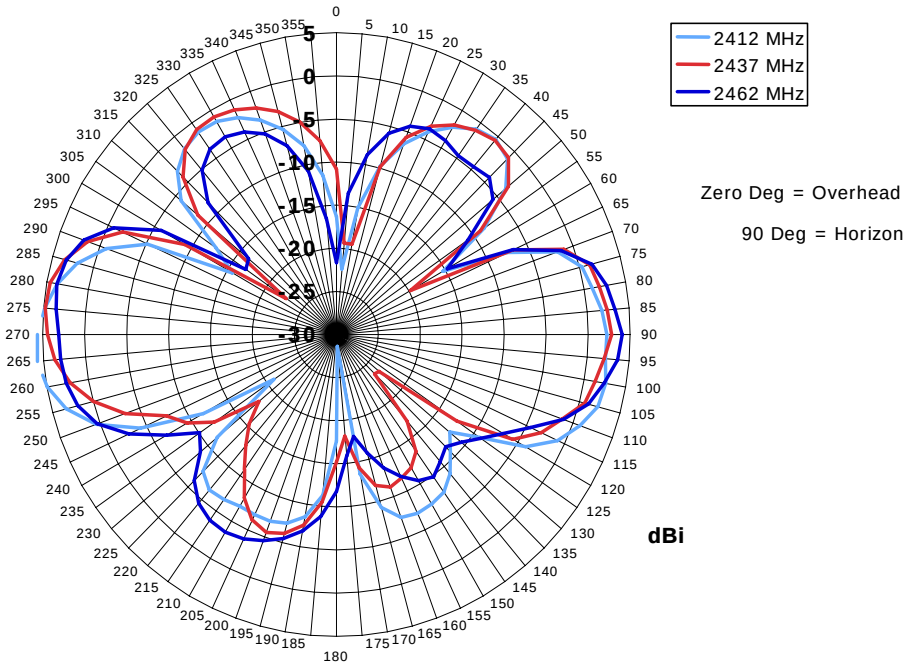
5 Order Number: DR4000088E6

- Omnidirectional Colinear Dipole Antenna
- Cushcraft Model S2403BPXN36RSM
- 2.4-2.5GHz, 4.9 dBi Gain
- Indoor/outdoor deployments
- Ideal for large open areas
- Pole or suspended ceiling mount
- Measures 11.5” x 1”

Azimuth Pattern
S2403BPXN36RSM

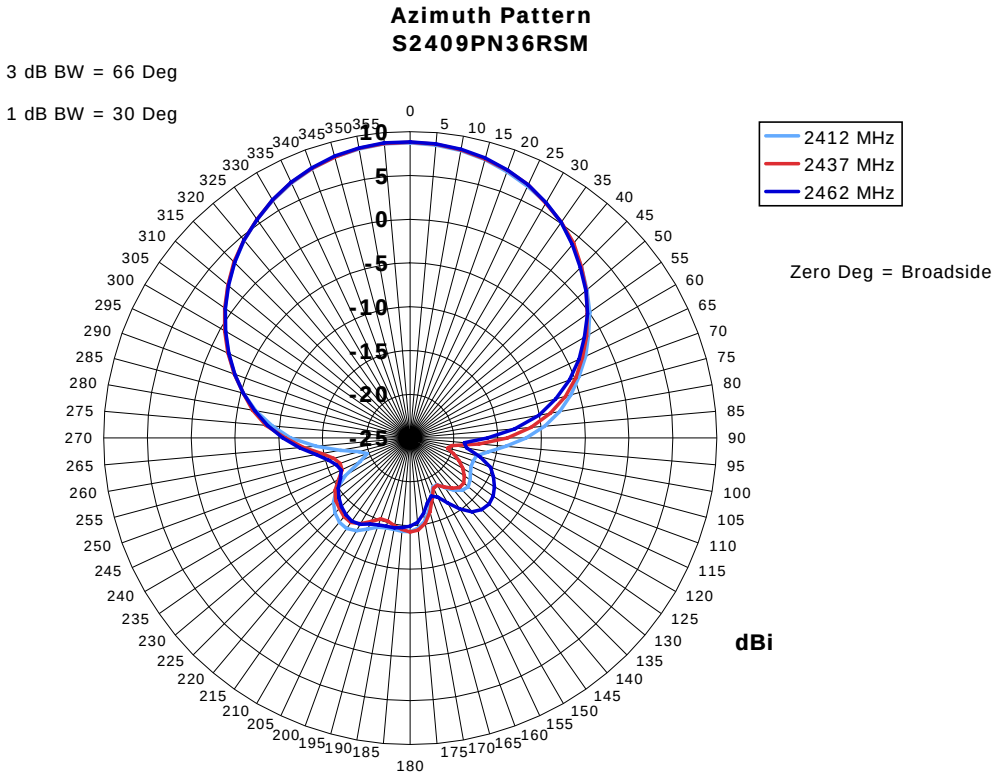


Elevation Pattern
S2403BPXN36RSM



6 Order Number: DR4000076E6

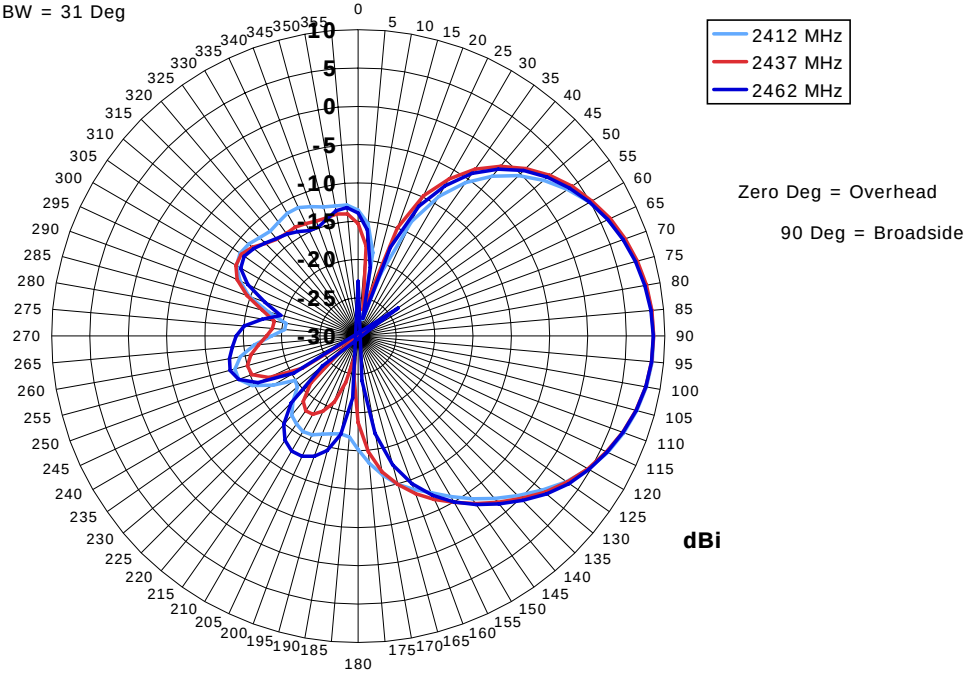
- Directional Panel Antenna
- Cushcraft Model S2409PN36RSM
- 2.4-2.5GHz, 8.8 dBi Gain
- Indoor/Outdoor deployments
- Well-suited for wall mounting applications
- Good for hallways and corridors where multi-path and scattering can be a problem
- 3 foot cable
- Measures only 6” x 6” x 1.25”


Azimuth Pattern
S2409PN36RSM
3 dB BW = 66 Deg
1 dB BW = 30 Deg
2412 MHz
2437 MHz
2462 MHz
Zero Deg = Broadside
dBi
10
5
0
-5
-10
-15
-20
-25

Elevation Pattern
S2409PN36RSM

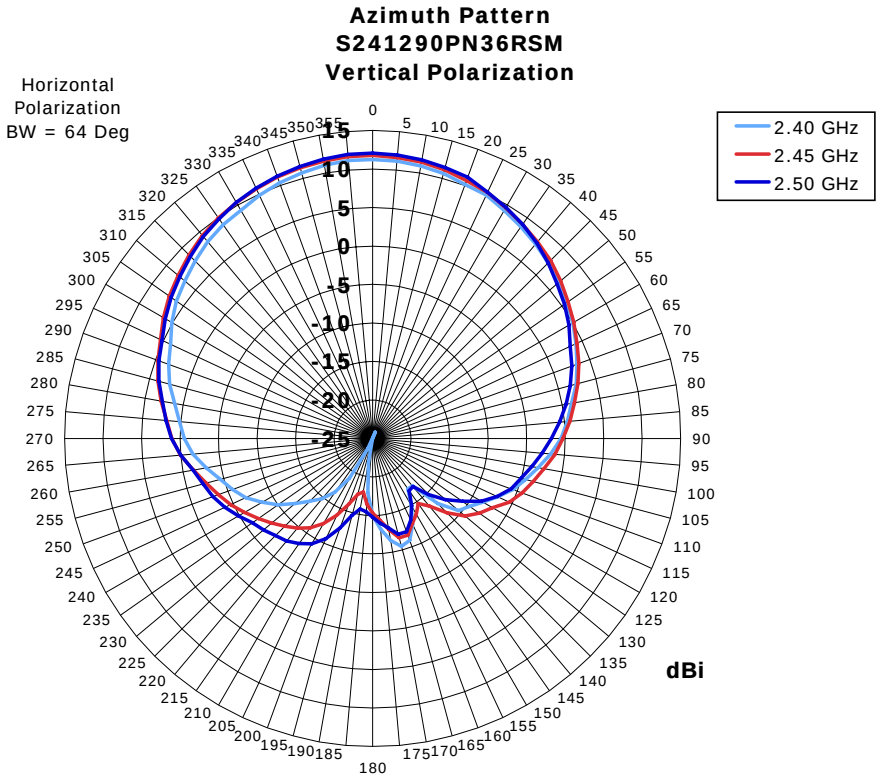
3 dB BW = 55 Deg

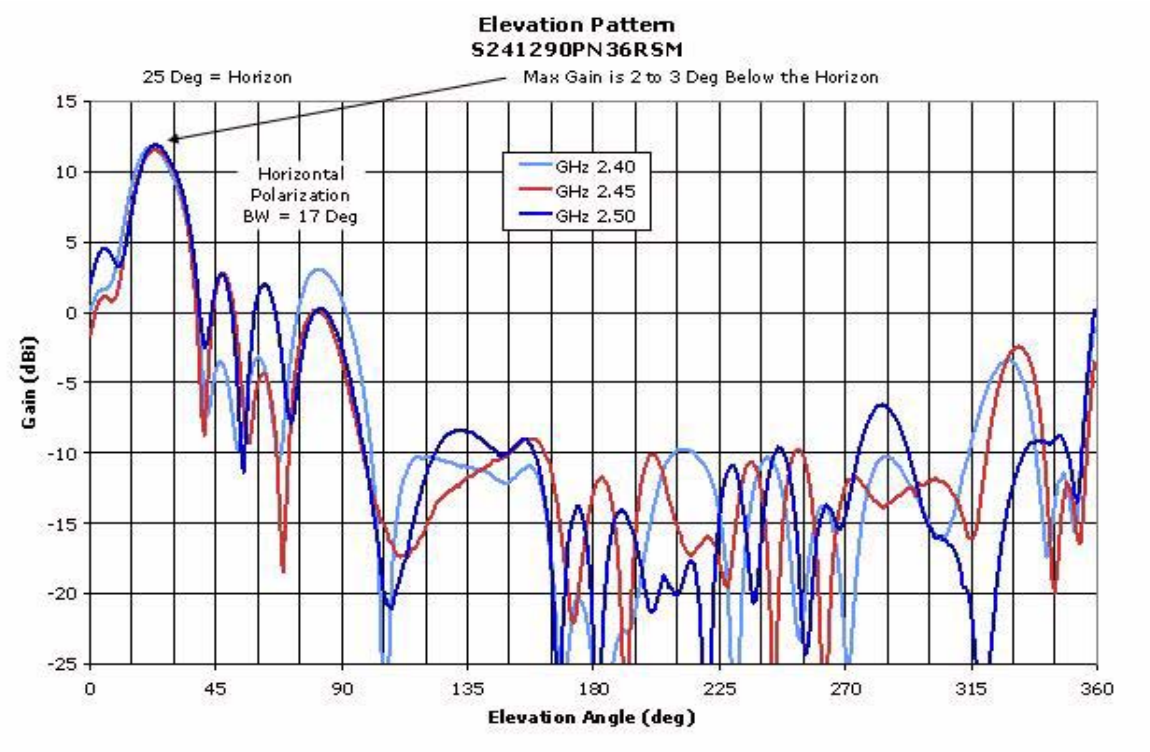
1 dB BW = 31 Deg



7 Order Number: DR4000086E6

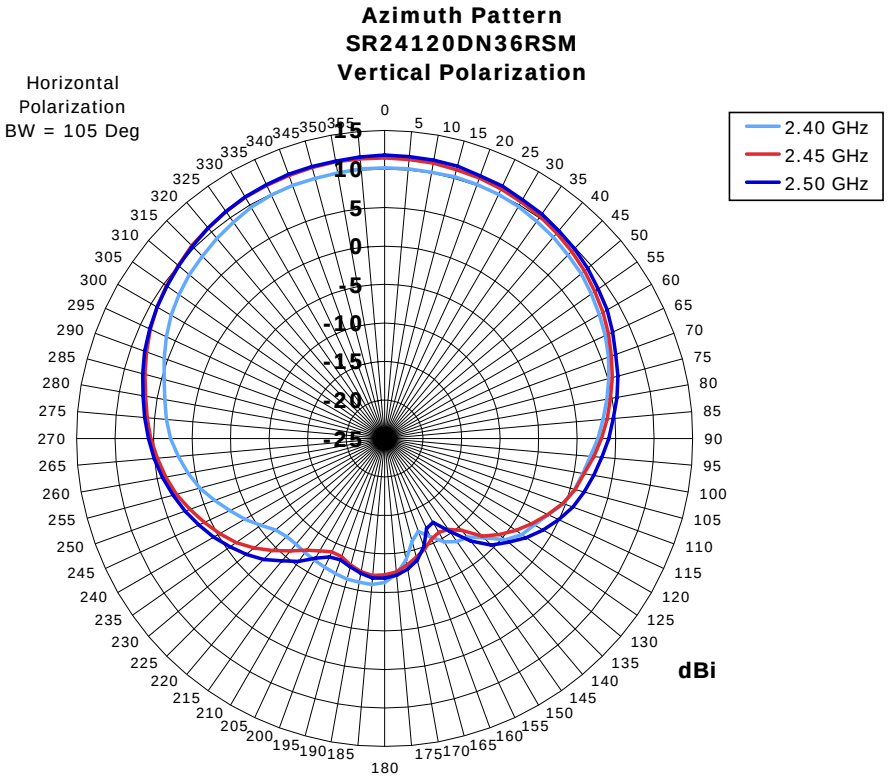
- Directional Patch Panel Array
- Cushcraft Model S241290PN36RSM
- 2.4-2.5GHz, 12 dBi Gain
- Outdoor deployments
- 90 degree H-plane and 17 degree E-plan
- Designed for long, wide coverage environments
- 3 foot cable with tilt mount available
- Measures 26" x 3" x 1"

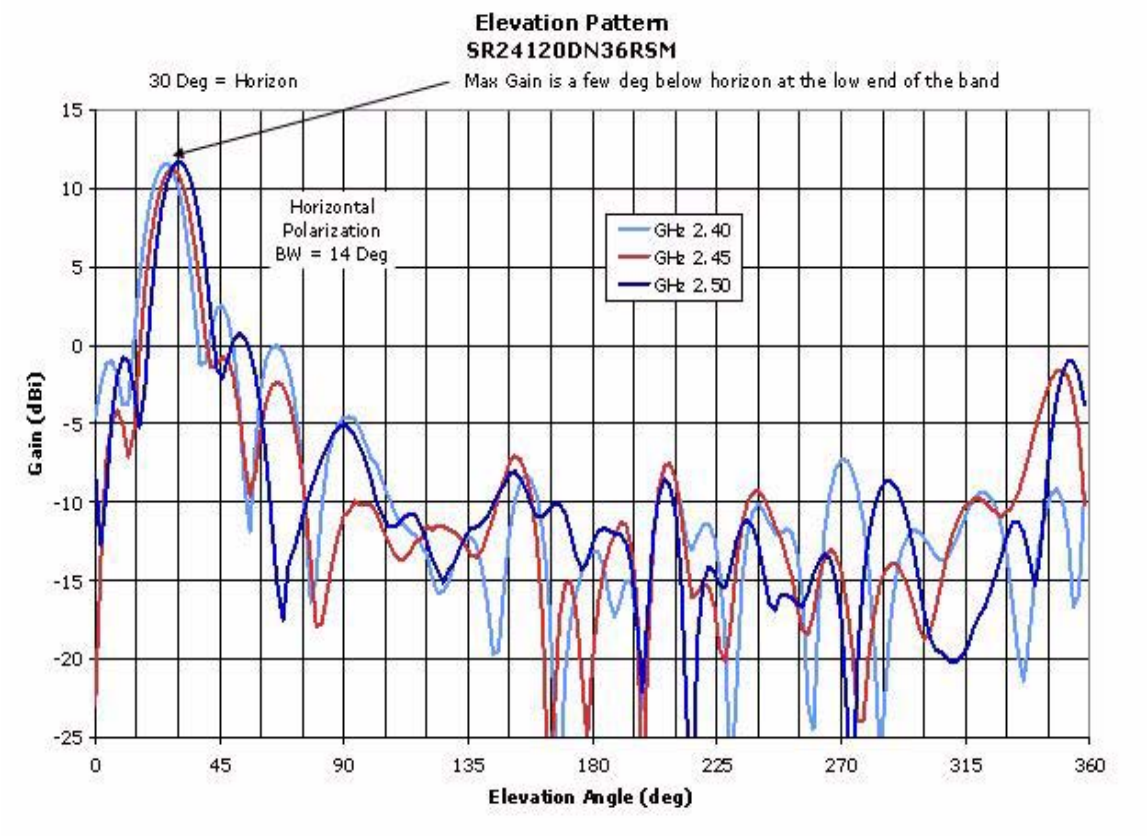

Azimuth Pattern
S241290PN36RSM
Vertical Polarization
Horizontal
Polarization
BW = 64 Deg
2.40 GHz
2.45 GHz
2.50 GHz
dBi
15
10
5
0
-5
-10
-15
-20
-25
0
5
10
15
20
25
30
35
40
45
50
55
60
65
70
75
80
85
90
95
100
105
110
115
120
125
130
135
140
145
150
155
160
165
170
175
180
185
190
195
200
205
210
215
220
225
230
235
240
245
250
255
260
265
270
275
280
285
290
295
300
305
310
315
320
325
330
335
340
345
350
355


Elevation Pattern
S241290PN36RSM
25 Deg = Horizon
Max Gain is 2 to 3 Deg Below the Horizon
Horizontal
Polarization
BW = 17 Deg
GHz 2.40
GHz 2.45
GHz 2.50
Gain (dBi)
15
10
5
0
-5
-10
-15
-20
-25
0
45
90
135
180
225
270
315
360
Elevation Angle (deg)

8 Order Number: DR4000087E6

- Directional Patch Panel Array
- Cushcraft Model SR24120DN36RSM
- 2.4-2.5GHz, 11 dBi Gain
- Outdoor deployments
- 120 degree H-plane and 14 degree E-plan
- Designed for long, wide coverage environments
- 3 foot cable
- Measures 23" x 3" x 2"


Azimuth Pattern
SR24120DN36RSM
Vertical Polarization
Horizontal
Polarization
BW = 105 Deg
2.40 GHz
2.45 GHz
2.50 GHz
dBi
15
10
5
0
-5
-10
-15
-20
-25
0
5
10
15
20
25
30
35
40
45
50
55
60
65
70
75
80
85
90
95
100
105
110
115
120
125
130
135
140
145
150
155
160
165
170
175
180
185
190
195
200
205
210
215
220
225
230
235
240
245
250
255
260
265
270
275
280
285
290
295
300
305
310
315
320
325
330
335
340
345
350
355


Elevation Pattern
SR24120DN36RSM
30 Deg = Horizon
Max Gain is a few deg below horizon at the low end of the band
Horizontal
Polarization
BW = 14 Deg
GHz 2.40
GHz 2.45
GHz 2.50
Gain (dBi)
15
10
5
0
-5
-10
-15
-20
-25
0
45
90
135
180
225
270
315
360
Elevation Angle (deg)

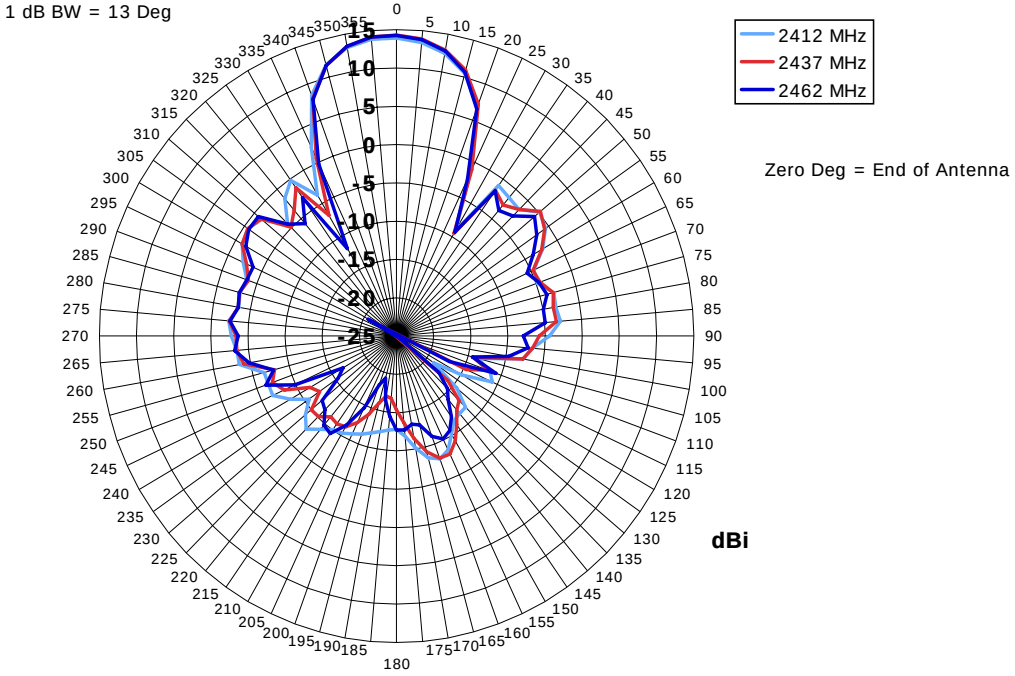
9 Order Number: DR4000077E6

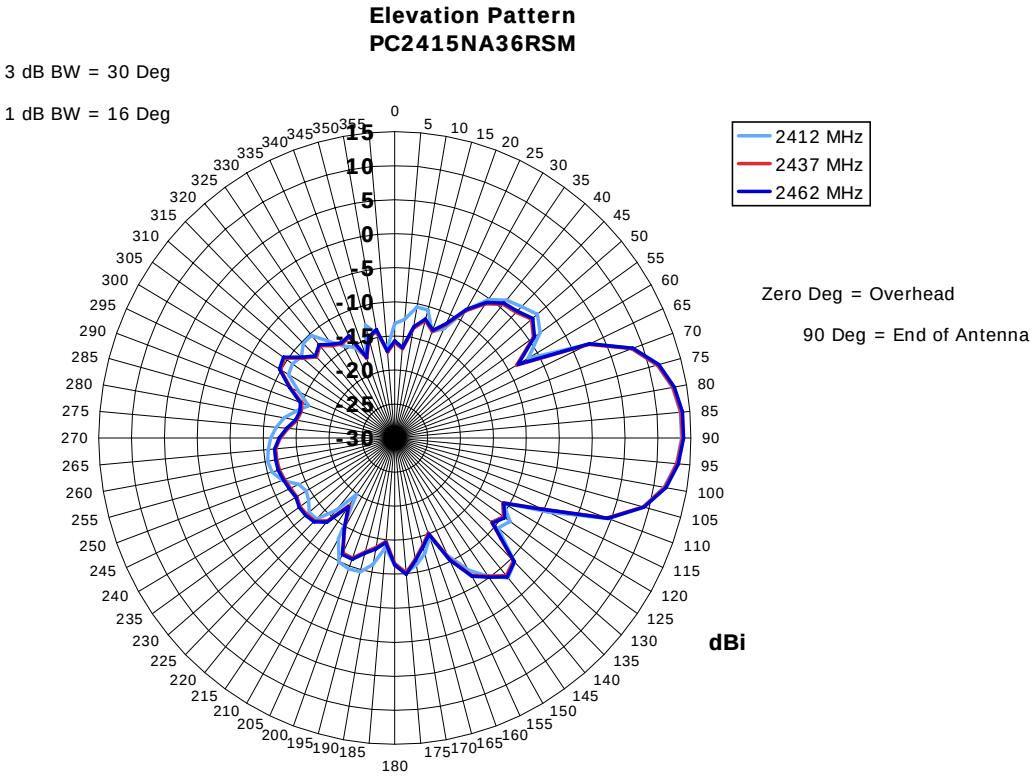
- Directional Yagi Antenna
- Cushcraft Model PC2415NA36RSM
- 2.4-2.5GHz, 14.1 dBi Gain
- Indoor/Outdoor deployments
- Articulating mount for precise direction
- Good for long and narrow zones like tunnels
- 3 foot cable
- Measures 26.5” x 3.75” x 1.5”

Azimuth Pattern
PC2415NA36RSM

3 dB BW = 25 Deg

1 dB BW = 13 Deg




Elevation Pattern
PC2415NA36RSM
3 dB BW = 30 Deg
1 dB BW = 16 Deg
2412 MHz
2437 MHz
2462 MHz
Zero Deg = Overhead
90 Deg = End of Antenna
dBi
15
10
5
0
-5
-10
-15
-20
-25
-30

Mounting of Ethernet Lightning Surge Protector

The following figures show the AL-CAT5 Dimensions for mounting the Ethernet Lightning /Surge Protector.

Figure 23. Top view

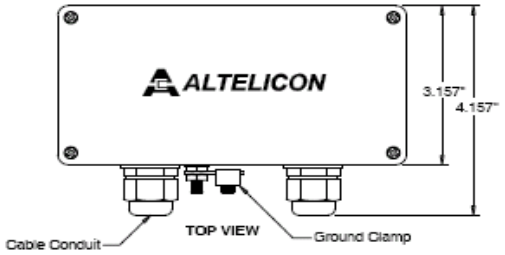


Figure 24. Bottom view

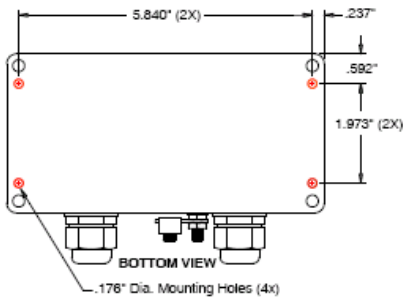


Figure 25. Side view

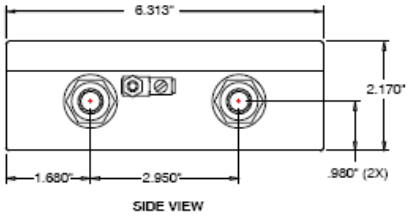


Figure 26. Mounting screws